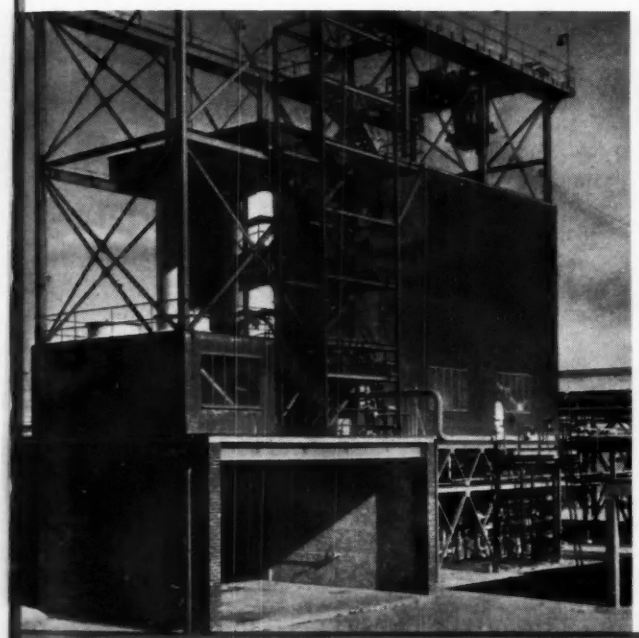
THE UNIVERSITY
OF MICHIGAN
JUL 1961
ENGINEERING
LIBRARY

Gas Journal

VOL. 306 | 113th YEAR | LONDON, JUNE 21, 1961 | No. 5103 | PRICE 1/6

NEWTON CHAMBERS install Britain's first high-pressure Gas purifiers—now in operation



Britain's first High Pressure Gas Purification Plant was installed by Newton Chambers and Co. Ltd., at Westfield under contract from Humphreys and Glasgow Limited who were the main contractors to the Scottish Gas Board for the Westfield (Lurgi Gasification) project.
Newton Chambers' agreement with Gottfried Bischoff, K.G., of Essen made this contract possible and enables Newton Chambers to meet other new demands of the gas and allied industries, including

OXIDE PURIFICATION • High Pressure and Low Pressure Towers

WET PURIFICATION • H_2S Removal by THE STRETFORD PROCESS

TAR EXTRACTION • DUST REMOVAL • GAS DRYING

NITRIC OXIDE REMOVAL • ORGANIC SULPHUR EXTRACTION

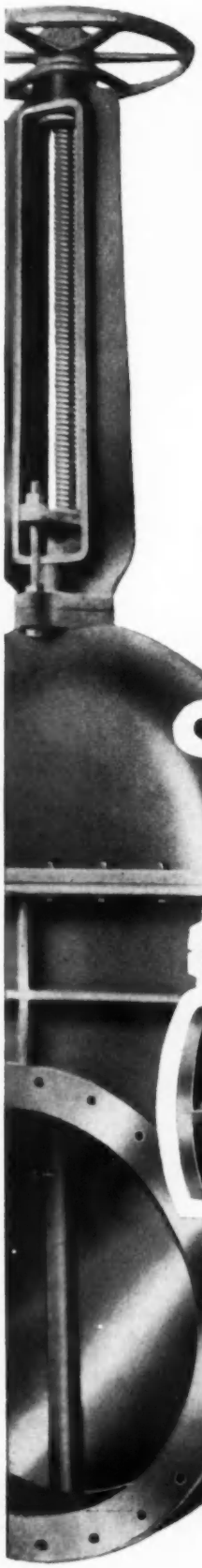
GAS COOLING & WASHING all Pressures **AND OTHER PROCESSES**

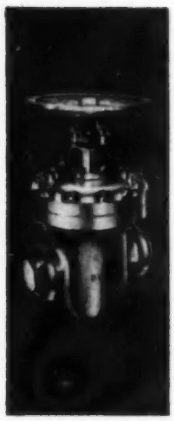
Newton Chambers were also responsible for the design and installation of the concentrated gas liquor plant at Westfield.

Newton Chambers

Remember the scope of NEWTON CHAMBERS

ENGINEERING DIVISION, THORNCLIFFE, SHEFFIELD





'FULBOR' VALVE

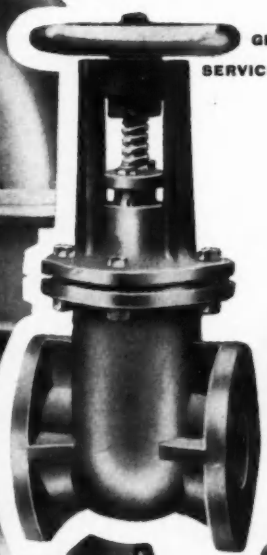
'C.L.' VALVE

'AIKEN' VALVE

Fulbor—300 Class Made in sizes from 3" to 24" Bore, particularly suited for high pressure pipelines up to 750 p.s.i.g. made with either flanged ends or welding necks.

C.L. Valves Made in sizes from 2" to 24" Bore, Cast Iron construction, Stainless Steel door, suitable for working pressures up to 100 p.s.i.g. on various types of gases. Flanged ends, Internal Screw operated.

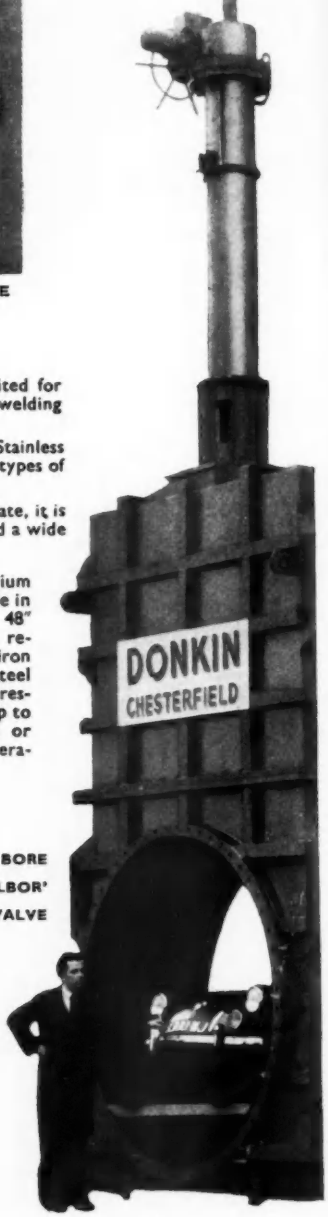
Aiken Valves Made in sizes from 3" to 15" Bore, Cast Iron spectacle plate, it is essentially a simple and economical low pressure valve, ideal for gas and a wide variety of chemicals. Internal Screw operated.



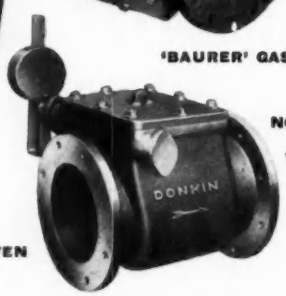
GENERAL SERVICE VALVE

Baurer Valves Medium pressure valve, made in sizes from 4" to 48" Bore, or larger if required, with cast iron or fabricated mild steel bodies. Working pressure on large sizes up to 45 p.s.i.g. Internal or External Screw operation.

'BAURER' GAS VALVE

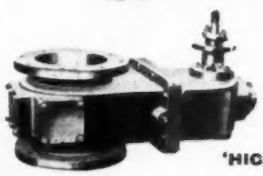


90" BORE 'SEALBOR' VALVE



NON-RETURN VALVE

COKE OVEN VALVE



'HICKS' VALVE

The BRYAN DONKIN Company Limited

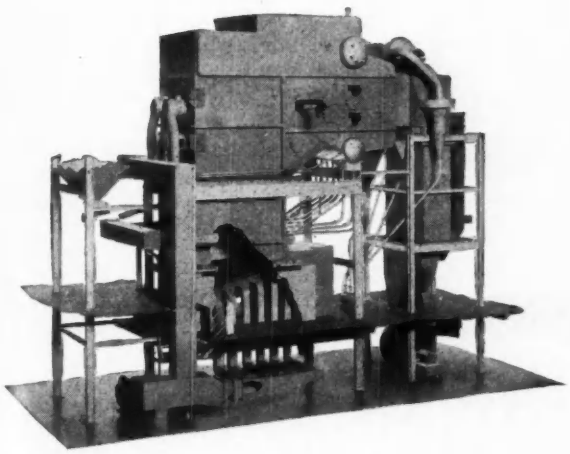
CHESTERFIELD Telephone 3153 **LONDON Telephone ABBey 1096**

BABCOCK BOILERS *with* ignafluid FIRING

supply steam to Britain's first Lurgi high-pressure gasification plant

Three 45,000 lb./hr. Babcock Bi-drum boilers supply steam at 450 lb./sq. in. to the new Lurgi high-pressure gasification plant of the Scottish Gas Board, at Westfield, Fife—first of its kind in Britain. This is also the first application in Britain of Ignafluid firing, developed by Babcock for the efficient combustion of fine, unmilled, low-grade fuels, including even coke-breeze dust and with ash-contents up to 40%, in boilers and some types of industrial furnace. The specification of Babcock boilers with Ignafluid firing is in keeping with the whole modern conception of the Westfield plant*, which is an important advance in British gas-production and in the development of the Scottish gas grid.

**Main Contractors: HUMPHREYS & GLASGOW LTD.*



Cut-away view (from a model) of a Bi-drum boiler with Ignafluid firing: showing the inclined travelling grate for slag-removal and divided ducting for the pulsating primary-air supply.

ASK FOR PUBLICATION No. 1711
"IGNAFLUID FIRING"

BABCOCK & WILCOX LTD
Babcock House • 209 Euston Road • London N.W.1

Gas Journal

VOLUME 306 • NUMBER 5103 • 113th YEAR

WEDNESDAY, JUNE 21, 1961

CONTENTS

EDITORIAL COMMENT

Britain's 'New' Gas Industry Makes Its Debut - 427

SPECIAL ARTICLES

NALGO Annual Conference - - - - - 429
Westfield: Britain's No. 1 Lurgi Project - - 431

BOOK REVIEW - - - - - - - 443

NEWS SUPPLEMENT

Minister Makes Helicopter Flight to Open Padiham Works of Main Morley Ltd. - - - - 451
£1½ Mill. Export Order for Power-Gas - - - 454
Long Service Awards - - - - - - - 454
More Natural Gas is Found in Sahara - - - 454
Simon Engineering: 1960 Results - - - - 454
Personal Notes - - - - - - - - 455
Coming Events - - - - - - - - 455
Arthur Smith: An Appreciation - - - - 455

Editor:
GEOFFREY W. BATTISON

Assistant Editor:
WALTER F. TRUMAN

Technical Editor:
CHARLES J. P. DE WINTON
T.D., M.A., M.I.Gas E., M.Inst.F.

Publishers' Notice, See Page 353, May 31, 1961.

Parkinson Cowan offer
their congratulations
to the designers, engineers,
and builders of the
Westfield Gasification Plant
—a magnificent new
addition to the gas industry

PARKINSON COWAN gas meters
A division of the Parkinson Cowan Group

Terminal House, Grosvenor Gardens, London S.W.1 Telephone: SLOane 0111

Export: Parkinson Cowan International Limited
Terminal House, Grosvenor Gardens, London S.W.1
Telephone: SLOane 0111/4 Cables: DISC London

PCGM 13

Gas Journal

COKE OVENS • BY-PRODUCTS • CHEMICALS

Britain's 'new' gas industry makes its debut

THE first Lurgi plant to be built in Great Britain has been commissioned and is making gas. This is an event of the very greatest importance to the British gas industry, not only because of its significance technically but also because, we feel, it ushers in a new era. We have almost become accustomed now to gasification of oil in Segas or Onia Gegi plants, the use of propane—or butane—air plants for the supply of peak load gas or the main supply to small isolated villages, and the reforming of refinery gases, but all these use an 'exotic' feed stock, oil.

Oil has to be imported, oil we are told is the fuel of today, but unfortunately Britain does not possess it in sufficient quantity to be self-supporting in its exclusive use. Britain does, however, possess coal, and that in large quantities. The Lurgi process makes use of a type of coal which cannot be processed by carbonisation. This coal is cheaper than the high rank coal generally used by the gas industry, and its ash content, within wide limits, is unimportant.

The output from Lurgi plants is high for the area covered by the plant, and here it shares an advantage with oil gasification plants. Since the process takes place under a pressure of some 30 atmospheres, the plant can be built at or near a colliery, away from a residential or built-up area, and the gas carried by pipe comparatively long distances without further compression.

It was with such thoughts as these in mind that we took part in a recent Press visit to the new plant at Westfield, Fife, which is to be officially opened by the Queen on June 27. We had a chance to inspect the site about 18 months ago, when the Scottish Gas Board invited the Press to make an interim report on the progress of the construction of the plant. The layout was therefore familiar, and the general arrangement of the plant and buildings had given some idea of the effect of spaciousness which was likely to be found on a second visit. There was no disappointment—first impressions were fully confirmed. Here is a plant worthy of any chemical industry, with sufficient likeness to a refinery to make the untechnically-minded realise that the oil industry need not claim all the credit for developing the glamour of auto-operation, or the use of unlikely ancillary plants. It is sufficiently similar to the more conventional chemical plant for the technical journalist to appreciate the finer points of layout and the ring mains carrying works services to individual sections of the plant.

These impressions were pleasing for those who claim to know something of both the industry's history and its endeavours in the last 12 years to overcome many seemingly insuperable problems facing it. But what about those outside the industry; its competitors, its detractors or even those who came for a 'story' and nothing more?

We feel they may have had something of a shock, for here is a fine example of modern chemical engineering, the result of enterprise on the part of the Scottish Gas Board and ingenuity in the search for suitable plant, and its installation, by Humphreys & Glasgow Ltd., the main contractors.

Perhaps it was significant that our guide, who so ably explained the intricacies of the oxygen plant, the high pressure boiler plant and the purification processes, was himself a recruit from the oil industry. It has been known that enterprising gas engineers have transferred their loyalties to the oil industry, but this is the first time we recall the traffic being in both directions. It is to be hoped that, as a consequence, the many difficulties experienced by the Area Board in finding suitable young men to train as engineers will be considerably eased.

What of the plant itself and those responsible for its construction at Westfield? Though imported from Germany as a fully developed process which had enjoyed much success in the gasification of brown coal even before the Second World War, the basic scientific work was, it is understood, carried out in this country some 30 or so years ago, at a time when research into reactions under high pressure was being undertaken in some of our university laboratories.

Interesting though the information obtained obviously was, it appears that its application to coal gasification in this country was not considered of immediate importance at the time. Carbonising coal

was available in quantity at a reasonable price, labour was easy to obtain, so there was really no need for the British gas industry to make the necessary effort to provide itself with plant based on anything so revolutionary.

Besides, oxygen on the scale needed, 'tonnage' oxygen as it came to be known, was not yet available in Britain. In Germany, however, where the quality of the coal available for gasmaking has on the whole, it seems, generally been of a lower quality than that in Britain, there seems to have been a much greater incentive to develop processes for its gasification and also for the production of motor spirit.

The latter process, the Bergius, for the hydrogenation of coal to petrol appears to have been the one to attract most interest in this country. The building of plant by I.C.I. at Billingham works, County Durham, in the early 1930's, attracted much attention at the time. The fact that this same firm had been able to exploit the Haber high pressure synthesis of ammonia when the details of this process became available after the First World War, put it in possession of high pressure techniques not shared by other firms in this country.

Advanced 'know-how'

Since this process was also developed in Germany, the 'know-how' necessary for the design and construction of plant was far in advance of anything in this country, if indeed it existed here at all in the 1920's. It is not surprising that so little should have been done in this connection in the British gas industry, even if the necessary resources had been available to do so.

Today, however, it would seem that our own engineering industry is well equipped to carry out the manufacture of the plant needed for high pressure work, and it is notable that Westfield's fourth gasification vessel was, in fact, constructed by the Power-Gas Corporation under licence from Lurgi of Frankfurt. The ancillary plant, coolers, benzole washers the Benfield plant, and the Bischoff oxide purifiers all working under high pressure have been made by British firms.

On this score then it would seem that nothing need stand in the way of fully exploiting the Lurgi process in other gas boards' areas, provided the plants can be sited in suitable localities near the source of raw material. This is a particularly important point since the high capital cost of the plant makes it necessary that raw material and its freight costs should be as low as possible. A point which must not be forgotten about the Westfield plant is that the particular collection of pieces and types of ancillary equipment which go to make up the whole had never been assembled on the same site before.

Since the process was new to the engineers of the Scottish Gas Board, it was necessary for them to make a number of journeys abroad to see what were the possibilities offered by this type of total gasification process and to visit plants in different parts of the world which were in actual operation. In this way they could not only investigate the potentialities of the process but discuss operating difficulties, maintenance problems and manpower needs. Having made its decision on the suitability of the process, the Board had then to see how it could be applied to the coal available on site, and also how the gas made could best be modified to the statutory requirements of the British gas industry.

The practical realisation of these decisions must naturally have fallen on the main contractors, Humphreys & Glasgow Ltd., whose responsibility it must have been to make themselves fully acquainted with all the available equipment anywhere in the world, for carrying out a particular task, and judging its suitability for this particular plant. The result has been a most carefully considered project, designed for a particular raw material working under rigidly specified conditions. The success or otherwise of the decisions as each step is taken would probably show up in the early period of the plant's working life, immediately after commissioning, in its teething troubles and the number of modifications demanded. It would appear that, in spite of this Lurgi plant being the first these contractors have built, its commissioning was without a hitch and within five days of starting up, gas from the plant was entering the supergrid under a reduced pressure. Shortly afterwards the main's pressure was increased to the full 250 p.s.i.

What will be the effect on the Scottish Board's gas availability as a whole? This particular output represents about one-fifth of the total consumption in the Board's area, some 90% of which is in the central industrial belt. Clearly it is in the Board's interest to keep the Westfield output at the highest possible load factor to take full advantage of a comparatively cheap fuel and to be certain of amortising the heavy capital cost within the 20-year contract period with the National Coal Board.

As the extensive new super grid system is completed so will it more nearly approach its ultimate goal of becoming a national grid for Scotland from which local networks may be able to reinforce their existing supplies.

At the extremities

A glance at the map of the grid mains in the industrial belt, leads us to think that this might be particularly so at its extremities, since those works producing gas at present, which will be retained, and outside sources of coke-oven gas, are concentrated in the Glasgow area, in which the average pressure of about 25 p.s.i. is far below the super-grid pressure, whereas in the Lothians, the Border counties and in Dundee and the Perth area, the volumes of gas involved are likely to be so much smaller that large scale works' closures may be possible.

The solution of Scotland's gas availability problems by the building of the Westfield plant has clearly taken a great deal of enterprise and careful planning to bring to fruition. The Board could have equally easily disregarded the presence of coal at the Westfield site, but it was clearly its eagerness and foresight that swayed the National Coal Board to exploit this particular deposit. It would seem that neither will regret having done so.

NALGO ANNUAL CONFERENCE

THE service conditions sub-committees of NALGO, each representative of the concerns of a particular industry, will become direct committees of the Association's governing body, the National Executive Council. This was stated by Mr. G. W. Phillips, the Association's Organising Officer for Gas Staffs, at a meeting of delegates from the gas industry which was held on the day before the annual conference of the National and Local Government Officers' Association. This meeting was held under the Chairmanship of Mr. K. W. Jones, of the National Executive Council.

Mr. Phillips suggested that gas members could be satisfied with what had happened during the year, but that their attention should now be directed to the future. Pay levels had in general been restored, in terms of what they would buy, to those of 1950. The next task was to examine the current national agreement to ensure that it provided comparability with other fields of employment where the duties were similar.

Unless this was done, the gas industry would not obtain or hold the staff needed in a modern undertaking. So far, from the evidence of Press advertisements for employment elsewhere, it could be seen that pay levels in the gas industry did not measure up to the responsibilities attached to the jobs. It was their task to see that this was corrected.

Mr. Phillips dealt particularly with the special scales payable to shorthand and other typists, machine operators, etc. A bar had now been placed, by the National Joint Council, in clerical scale A/B, at the £560 point for those whose duties were of a simple routine character; in the opinion of the staff side there should be a review of the gradings of those on special scale salaries in the light of this figure. Grading was a matter for area boards, and the staff side had been asked to look at this matter.

The salaries of senior gas officers were now under review by the officers' side, who had invited the members to provide material by way of a questionnaire; they were trying to establish the facts about salaries in relation to responsibilities, to see whether similar duties in different areas had or had not the same remuneration, and how these compared with corresponding posts in other fields of employment.

Unfortunately the officers' response to this request had been poor, but it had at any rate sufficed to establish that the general level of pay was lower in the gas industry than elsewhere. This finding had been put before the Senior Gas Officers' Council.

The staff side would like to see an end of the right given to individual officers to opt out of the negotiating machinery. They were convinced that this was as detrimental to the interests of those who chose to opt out, as of those who preferred to use the joint negotiating machinery to determine their service conditions. A proposal to abolish this arrangement had been put forward as a suggested alteration of the constitution.

The machinery for negotiating on intermediate grades was now unnecessary, since the staff within its purview were within the scope of the National Joint Council or the National Joint Industrial Council; a formal proposal to disband it had accordingly been put forward.

The Gas Council, Mr. Phillips reported, had consented to consult with the unions and associations on pensions questions, and he thought that, as a result of current negotiations, arrangements for the payment of deferred pensions to people leaving the industry on redundancy might be expected. Compensation for loss of office was also under discussion; in this field it was governmental opposition with which they had to contend, the Gas Council itself being well-disposed towards the staff side's objective.

NALGO membership in the industry was rising, in spite of the fall in the total numbers employed. The question of fusion with the British Gas Staffs Association, which had been on the agenda paper for many years, had, Mr. Phillips said, been advanced during the year. A formal proposal for amalgamation had been put to the B.G.S.A. and representatives of the two organisations were now discussing possibilities.

The executive proposed to incorporate in NALGO's constitution provisions for calling and financing a strike. The executive believed that they must have power to use the ultimate weapon—the withdrawal of labour. Without this, said their spokesman, they would cease to be free men.

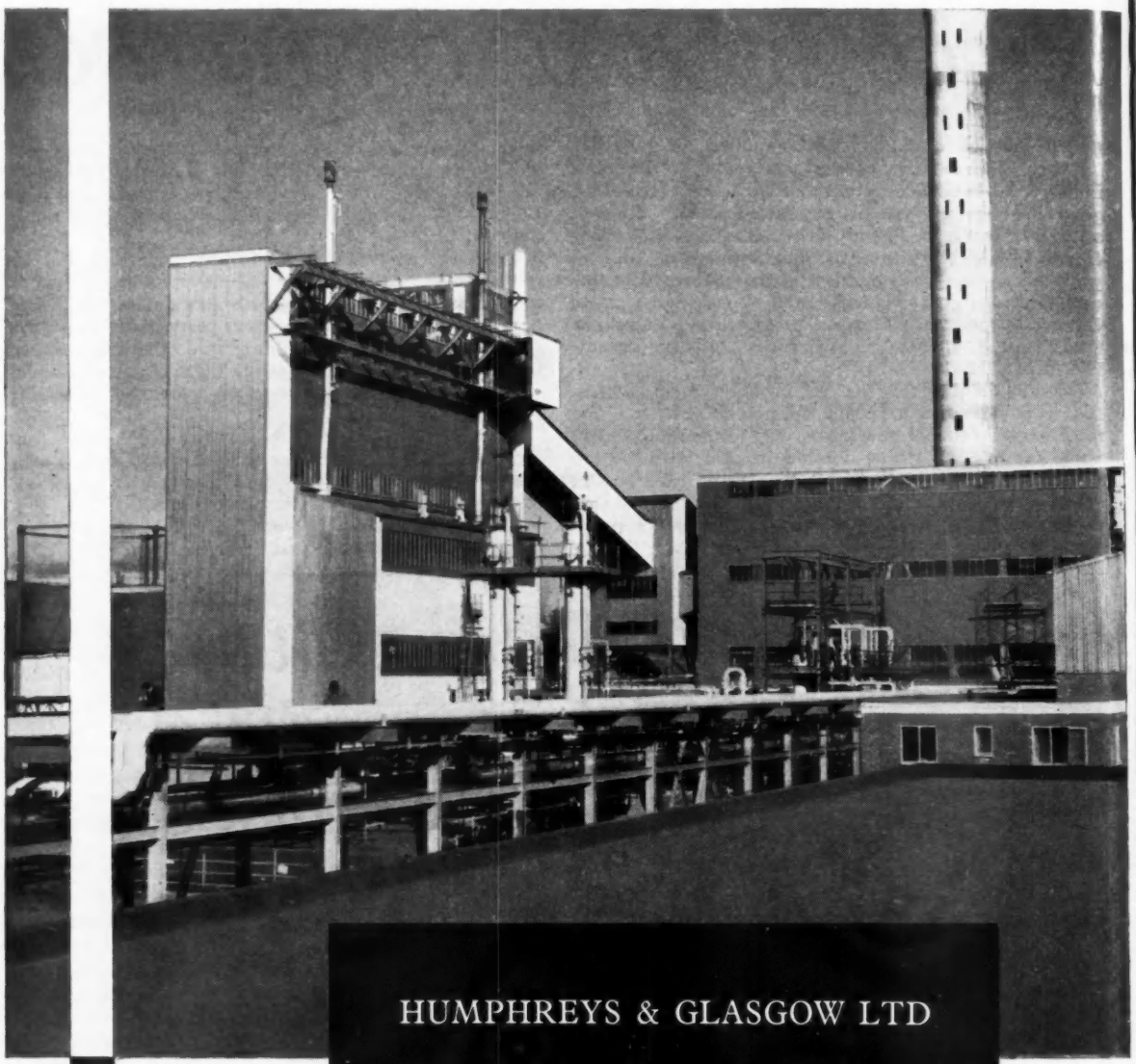
The special position of gas staffs was explained by the General Secretary, Mr. W. C. Anderson, who was followed by Mr. A. Blue (Glasgow). Mr. Blue was confident that if occasion arose in the gas industry, legal means would be found of enabling staff to withdraw labour.

Speakers supporting the proposal emphasised that the power to strike would not be used lightly or irresponsibly; that the primary method of winning improvements would continue to be negotiation; and that only in extreme cases in which employers denied fundamental rights would the alternative be considered. When the vote was taken the proposal was approved by a very large majority.

Mr. John Hare, the Minister of Labour, addressed the conference and said that the 'bulge' in the population would enable many employers to recruit the boys and girls they needed. This made it important that they should make the fullest use of their varying abilities, and this could be done only if they had proper training. Training was not related solely to apprenticeships in traditionally skilled crafts. It was relevant also to the increasing proportion of people in non-manual and service occupations. He congratulated NALGO on its contribution through summer schools and scholarship schemes.

The importance of joint consultation not only at national but at local level was emphasised by Mr. Hare. It was not enough for agreements to be made and good relations established between leaders of employers' organisations and trade unions; they should see that the same spirit pervaded the relations between every worker and everyone in authority over him.

GAS INDUSTRY DELEGATES MEET—DISCUSS SALARIES



HUMPHREYS & GLASGOW LTD

chemical engineers, designers and

MAIN CONTRACTORS

to the Scottish Gas Board for

the pressure gasification plant

at Westfield, Fifeshire

HUMPHREYS & GLASGOW LTD, 22 CARLISLE PLACE, LONDON, S.W.1

Telephone: VICtoria 8484 Telex: 25809

Also in Canada, Australia, France, Germany, S. Africa, India, Japan

BRITAIN'S No. 1 LURGI PROJECT

WESTFIELD

THE QUEEN TO OPEN PLANT NEXT WEEK

THE Lurgi plant at Westfield in Fife to be officially opened in a week's time by Her Majesty the Queen, will be the first of its kind in Britain and only the third in the English speaking world; the other two are at Sasolburg in South Africa and Morwell in Victoria, Australia.

The first stage of the project has now been completed and the works is at present producing 15 mill. cu.ft. of gas a day. When the second stage is completed in a few months' time this output will be doubled to 30 mill. cu.ft. of gas a day, equivalent to one-fifth of the present total demand for gas in Scotland.

In order to take full advantage of these large volumes of gas becoming available at high pressure the Scottish Gas Board are constructing a high-pressure pipeline across central Scotland which, when linked with existing grid systems will enable gas from Westfield to be distributed over an area of 4,000 sq. miles. The estimated total cost of the works is £6.6 mill. and the high pressure pipeline a further £1.9 mill., making a total of £8.5 mill.

Little precedent

The main contractor for the construction of this plant is Humphreys & Glasgow Ltd., of London. Since this was a unique project, and there was little precedent for the assembly of the component process plants, although the principle of the Lurgi process itself had been employed elsewhere, teams of engineers were sent abroad to technical organisations and manufacturing plants in many parts of the world to analyse, prove and negotiate the most suitable process for a particular duty.

The location of the site at Westfield set its own problems and a site model helped to solve a number of them. One was to ensure that the Lurgi plant would, as far as possible, blend with its pleasant rural surroundings and to achieve this the Scottish Fine Arts Commission was consulted by both the contractors and the Scottish Gas Board in the design stages.

Laid out on a 45-acre site which was largely peat bog, and flooded mine workings, the building of this works involved a major civil engineering project being undertaken before construction of the plant could begin.

Test borings and seismic surveys revealed good load bearing strata, but spurs of igneous rock which thrust near the surface had to be blasted away to provide the required foundation levels. The levelling of the site involved the excavation of 50,000 cu.yds. of soft soil and peat moss and its replacement by hard filling.

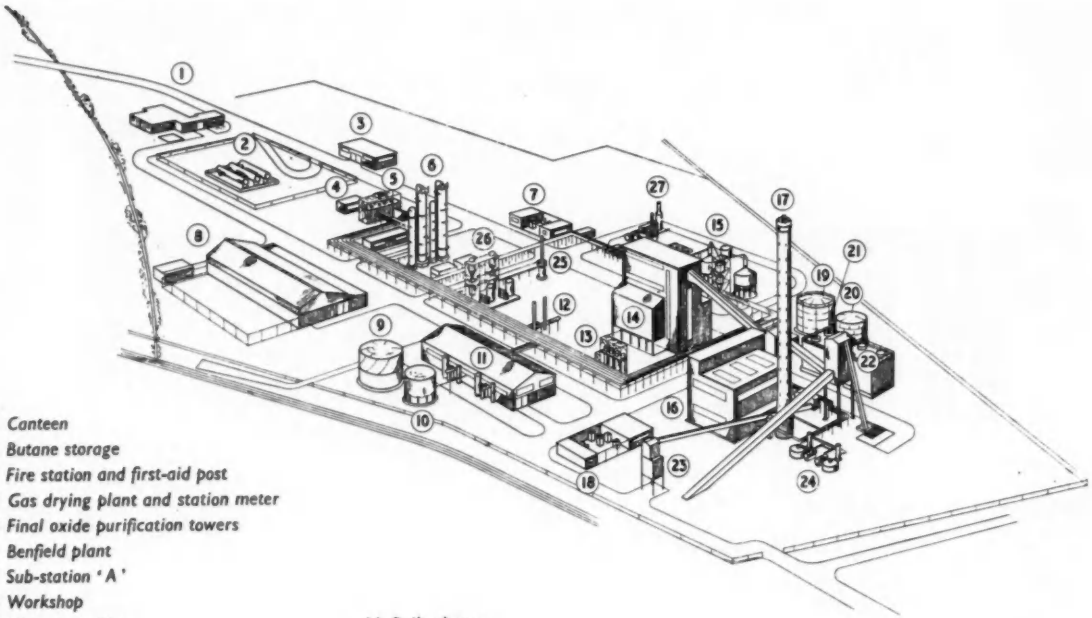
Since there could be no tolerance for differential settlement, piled foundations were necessary and the rock being at varying depths certain self-contained plants had to be supported by a combination of piled and mass foundations. This was accomplished by the use of 17-in. nominal diameter Franki bored piles. This system is the most economical in dealing with the large variation in the length of piles needed. A total of 874 piles were driven, each with a working load of 60 tons. Their average length was 22 ft., though the length of individual piles varied between 10 ft. and 38 ft.

Many of the large items of plant to be transported to Westfield were off-gauge loads. They were large and heavy and were of the kind that need police escorts and precise and patient negotiation through built-up areas and traffic bottlenecks. Some of the transporting was done by relays of vehicles and crews so that the components could be on the road to Westfield day and night.

The erection of equipment on the site was often a major problem. Of all the heavy lifting, that of the complete vessels for the Benfield plant was the heaviest. Gin poles and double winches with a capacity of 200 tons were used and the actual lift from start to finish for each vessel took five hours.

Through two bad Scottish winters, the construction continued. Men erecting steel structures worked on girders and scaffolding at times in bitterly cold weather. To prevent winches freezing up, braziers were kept burning beside them.

One of the first services needed at the Westfield site was electricity. Power lines had to be laid before the building foundations were put down. This meant that the location of every line had to be accurately surveyed so that after power cable conduits were buried underground they



1 Canteen
2 Butane storage
3 Fire station and first-aid post
4 Gas drying plant and station meter
5 Final oxide purification towers
6 Benfield plant
7 Sub-station 'A'
8 Workshop
9 Nitrogen holder
10 Liquid oxygen storage
11 Oxygen plant
12 Benzole absorbers
13 Lurgi after-coolers
14 Lurgi house
15 By-products area
16 Boiler house
17 Chimney
18 Sub-station 'B'
19 Lock gasholder
20 Effluent storage tank
21 Cooling towers
22 Coal screening plant
23 Ash bunker
24 Acid gas disposal plant
25 Start-up heater (for carbon monoxide conversion plant
26 Raw gas carbon monoxide conversion plant
27 Ammonia treatment plant

Artist's impression of Westfield works.

would not be damaged or disturbed in any way by subsequent surface operations.

The quantities of material used in the construction of large industrial undertakings are always impressive, and some of those used at Westfield are of interest. Here there are over 2,000 tons of steel of all kinds, 1,100 tons of pipework, over 25 miles of power cables, more than eight miles of underground ducts, over 1,500 light fittings and more than 200 electric motors. Approximately 42,000 tons of concrete have been used.

Every constructional and administrative facility needed to keep the work up to schedule and running smoothly was provided on the site. There were a large pipe fabrication shop, in which the piping was manufactured from the drawings, various workshops and stores, drawing offices, and accommodation for technical, administrative and clerical staffs.

Opencast coal

A suitable low rank non-caking opencast coal for processing in the Lurgi gasifiers—totally unsuitable for gas-making by orthodox means—is obtained from the adjacent workings of the Opencast Executive of the National Coal Board under contract, which provides for adequate supplies being made available to the works for a period of 20 years, or during the life of the opencast workings, whichever is the longer.

This coal as charged consists of a mixture of washed coal, size 1½ in. to 1 in., to which a proportion of middlings of high ash content from the washery has been added. It is delivered to the works by railway wagon, and carried by conveyor belt—fitted with K.A.M. conveyor belt brushes supplied by the Kleen-e-ze Brush Co., Ltd.—to the gasifiers. The total ash plus moisture content of the coal charged is maintained at 30%, its calorific value is in the neighbourhood of 8,600 B.t.u. per lb., and the fusion point of its ash 1,450°C.

The Lurgi gasifier is a mild-steel high pressure vessel of fusion-welded construction, the first three of which were supplied from Germany, but the fourth for the second-stage of the project was manufactured by Ashmore, Benson, Pease & Co., Ltd., for the Power-Gas Corporation Ltd. in agreement with Lurgi and Humphreys & Glasgow Ltd. This is the first such vessel to be manufactured outside Germany. The main vessel is approximately 19 ft. high overall with an outside diameter of 10 ft.

The coal enters through a lock-hopper attached to the top of the gasifier; steam and oxygen at high pressure are introduced at the lower end; and the gas is generated by the reaction of steam and oxygen with the coal at a pressure of about 30 atmospheres. Each gasifier produces upwards of 7½ mill. cu.ft. of gas a day. Normally with the present output of the works two are in use with one as a stand-by.

Though designed for an output of 7½ mill. cu.ft. per day, from experience so far gained from actual working of the plant, it has already been found possible to achieve steady gas production rates of over 10 mill. cu.ft. per day from each gasifier, or an increase of over 30%, while the consumption of steam and oxygen per 1,000 cu.ft. of gas made, is substantially below that expected.

Charging of the Lurgi gasifier is carried out by hydraulically operated gear under the control of the Lurgi house attendant. The lock-hopper is depressurised to atmospheric pressure, the lean gas being taken to a small sub-

sidiary column-guided all welded holder of 50,000 cu.ft. capacity supplied by Firth Blakeley, Sons & Co., Ltd., and used on another part of the plant.

The hopper is filled with coal from an overhead bunker and after closing the coal valve, is repressurised from the Lurgi vessel itself. Ash withdrawn from the base, also through a lock hopper is dumped in an ashbin from which it is taken by railway wagon back to the colliery where it provides a filling for the open cast workings.

Process steam

Crude gas leaves the gasifiers at a temperature of between 400 and 450°C. Liquor is sprayed into the gas in a quench cooler, and its temperature is reduced to about 196°C. This allows the fullest use to be made of the latent heat of the gas as it passes through the waste-heat boilers, supplied by the Power-Gas Corporation, Ltd.; and considerable quantities of low-pressure steam are obtained and used as process steam in the purification plant.

The gas passes from the waste-heat boilers to a pre-cooler and from thence in twin streams to another installation of coolers, each stream of which consists of two vertical tubular water-cooled heat exchangers in series called respectively the 'after-cooler' and the 'final-cooler.'

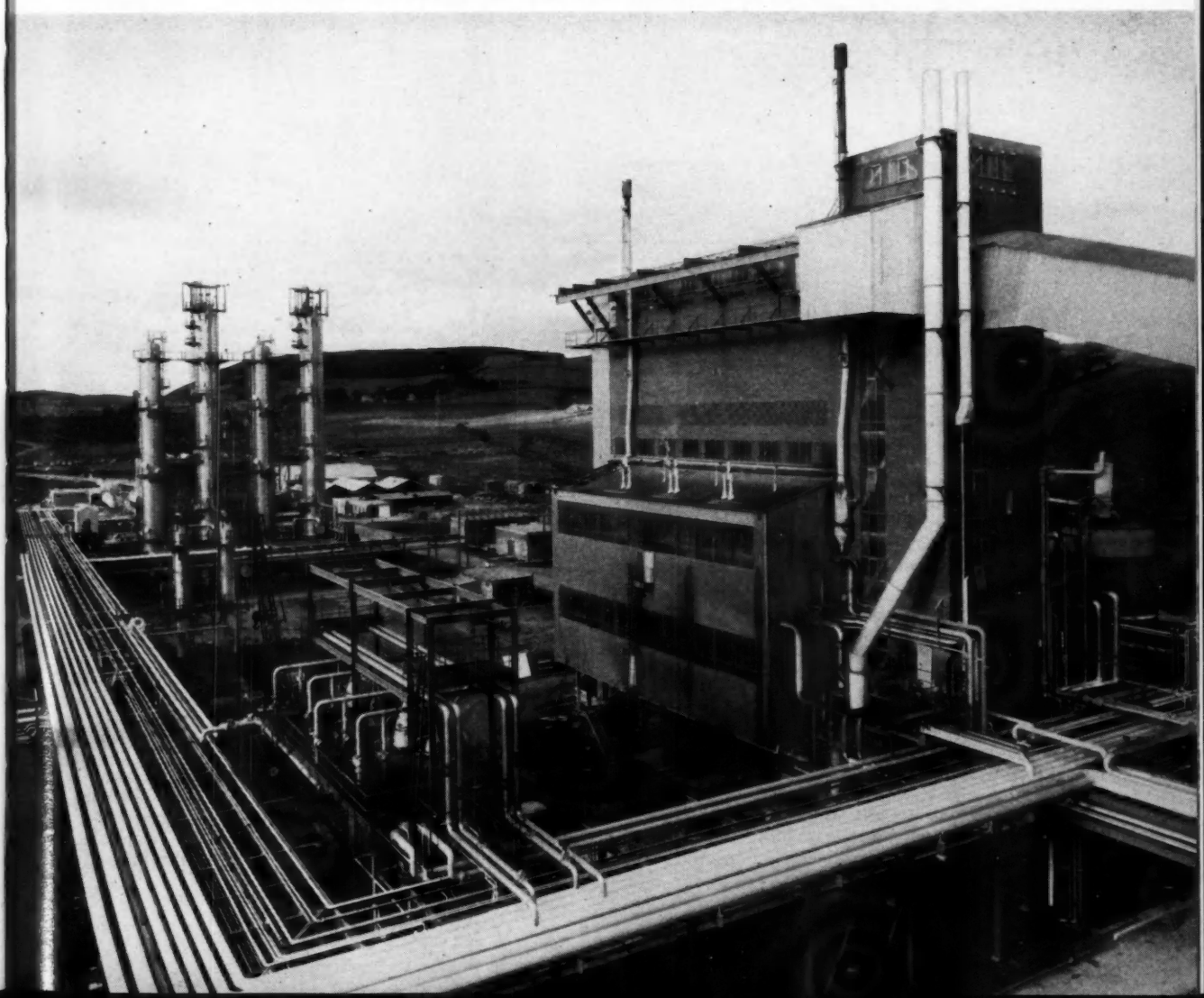
After leaving the coolers the gas passes through various stages of purification. Benzole is removed by washing with light oil. Designed by Humphreys & Glasgow Ltd., and manufactured by Babcock and Wilcox Ltd., the benzole scrubbers consist of two towers each 45 ft. high and 3 ft. 6 in. internal diameter, fitted with bubble cap trays and capable of working under a pressure of 384 p.s.i.g.

Carbon dioxide and hydrogen sulphide are then removed by passing the gas through the Benfield plant—named after its inventors, Mr. Benson and Mr. Field of Pittsburgh, U.S.A.—the tall towers of which are one of the most striking features of the works.

The carbon dioxide content of the Lurgi gas when it leaves the coolers is approximately 27%; and the hydrogen-sulphide content about .8%. The high carbon-dioxide content must be reduced in view of its effect on the calorific value of the gas. Essentially, the Benfield process involves the absorption of carbon dioxide and hydrogen sulphide in a 35% solution of potassium carbonate at high pressure and at a temperature of approximately 110°C.

The carbon dioxide and hydrogen sulphide react with the potassium carbonate to form potassium bicarbonate and potassium bisulphide respectively; the solution leaves the absorber and, after a reduction of pressure from 325 p.s.i.g. to 5 p.s.i., passes to a regenerator vessel where conventional steam stripping is carried out at the same temperature.

View from the boiler house showing the pipebridge and Lurgi house.



The plant consists of two pairs of two towers, each packed with 1¼-in. porcelain Raschig rings supported on 3-in., 2-in., and 1½-in. Lessing rings in successive layers. The two shorter towers, 108 ft. high by 8 ft. diameter and constructed of 1⅛-in. mild steel plate, are the absorber vessels, while the two taller, 120 ft. 9 in. high by 10 ft. 9 in. internal diameter, standing on a 10-ft high skirt and constructed of varying shell thicknesses along their length, are the regenerator vessels. The complete installation comprises pumps and other ancillary machinery. The central control room for this section of the plant is also located here. Before these very long vessels could be transported from the factory to the site, they were cut in half, and were rewelded on arrival.

The acid gases—or waste gases—leaving the top of the regenerator towers consist of approximately 98% of carbon dioxide and 2% of hydrogen sulphide. After being cooled they pass to a catalytic conversion plant where all hydrogen sulphide is oxidised to sulphur dioxide. The waste gases are then mixed with boiler flue gases and finally pass to the main chimney stack. Plant for the recovery of sulphur in its elementary state from the waste gases will be installed during the second stage of the construction of the works.

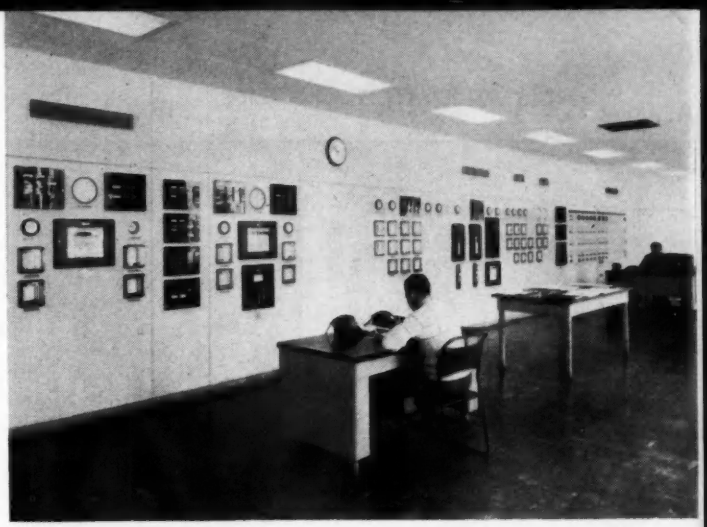
The suppliers of this plant Simon-Carves Ltd., are building a pilot plant to prove the practicability of installing the full scale plant when stage 2 is in production. When the whole plant is finally completed, more than 10 mill. cu.ft. of waste gases will have to be disposed of daily.

The necessary pumps for handling benzole, wash oil, dilute ammonia liquor and tar in the by-product section, are end suction, open vaned impeller centrifugal pumps with external ball bearings, supplied by Lee, Howl & Co. Ltd. Each pump, a horizontal, single stage electrically driven unit is of robust construction, and dismantling for inspection can be effected in a few moments by removing the suction cover and withdrawing the impeller and water passage from the end of the shaft. Easy maintenance facilities are vital in a plant of this kind.

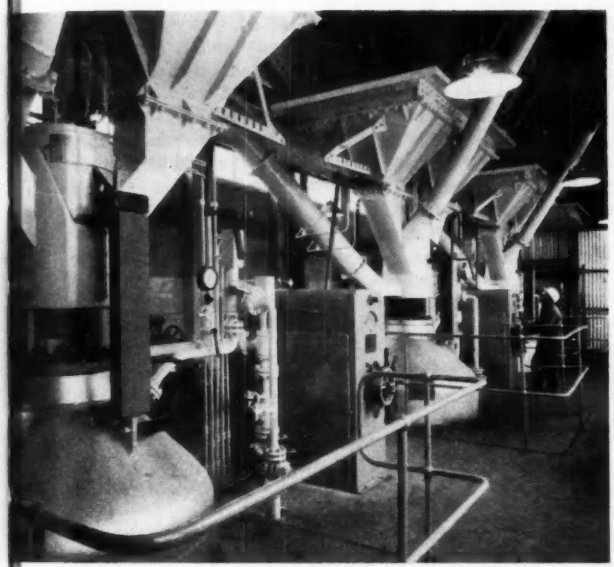
The Benfield plant has been designed to give an absorption efficiency of carbon dioxide and hydrogen sulphide of over 90% so a further purification stage is necessary to comply with statutory requirements before the gas passes into the grid main. This is carried out by the Bischoff

system of oxide purification, in which the gas passes through two streams each of four towers designed to operate at a pressure of 340 p.s.i. The Westfield plant has been supplied by Newton Chambers & Co. Ltd., who hold the exclusive rights from Bischoff of Essen to build these plants in Britain.

Each purifier tower and one of two stacking towers are provided with 12 trays containing hydrated iron oxide. Essentially, the system operates on the principle that the oxide is removed in rotation from one tower to another at specific intervals and the towers themselves always remain in the fixed rotation order of 1, 2, 3, 4. By this arrangement the need for the large number of valves usually associated with oxide purifier systems has been obviated. The inlet and outlet main to each stream are provided with two valves for double isolation, the space between these two valves being vented to atmosphere through a vent valve.



The works control room is seen in the top picture.



Left : Inside the Lurgi house at coal lock level.

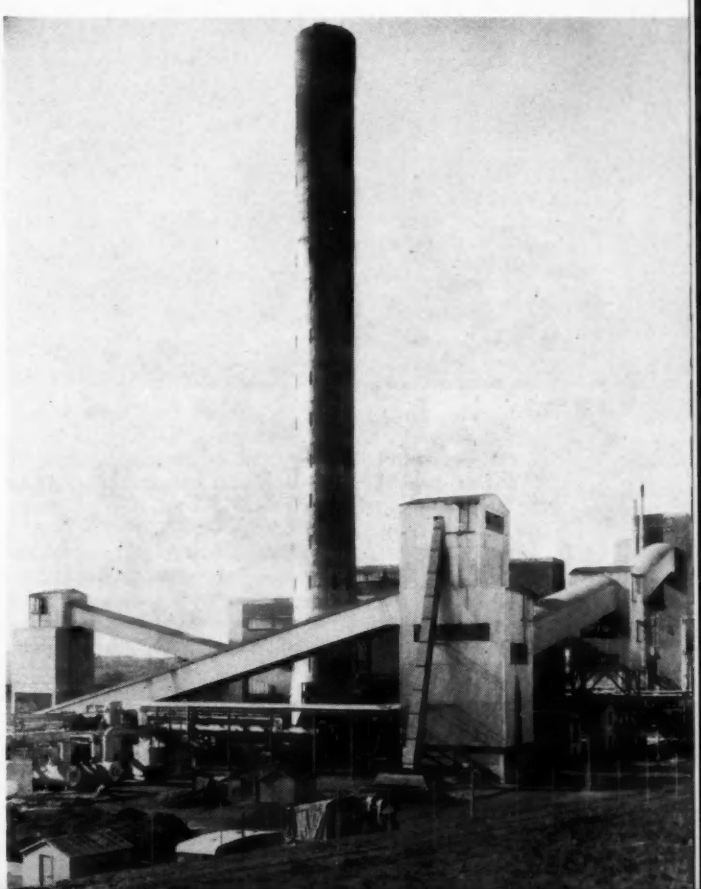
Normally both streams will be in action, but when it becomes necessary to renew the purifying material, one stream is completely shut off leaving the other stream temporarily to carry the full load. After the idle stream has been depressurised and purged with inert gas, the appropriate towers are then opened; the oxide trays in tower 1 are removed and placed in the empty stacking tower; the trays in towers 2, 3 and 4 are moved back to towers 1, 2 and 3; and finally a set of trays containing a fresh mixture of revivified and new oxide are placed in tower 4. The fouled oxide placed in the stacking tower is then removed for revivification. A four-ton electrically-driven overhead crane is provided for lifting the tower covers and transferring the trays.

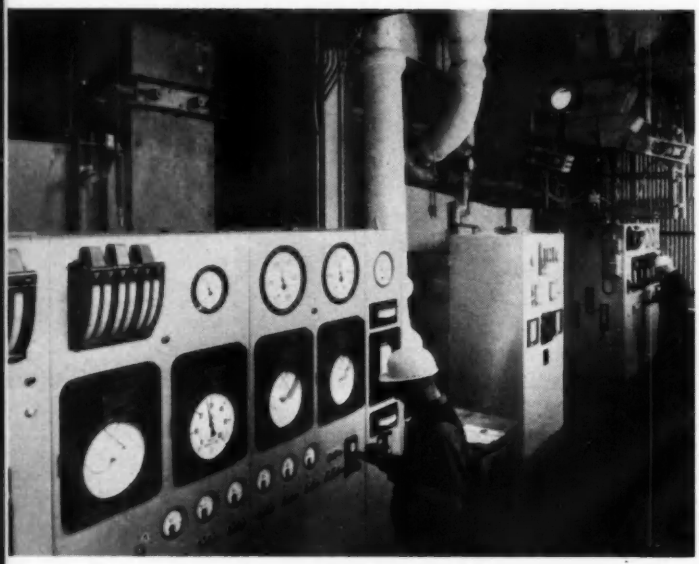
The oxide-changing operation on one stream can be carried out in one working day; the period between these operations is expected to be about 22 days on maximum load. They will therefore be 'staggered', one stream being shut off every 11 days.

After drying, the purified Lurgi gas is 'conditioned' so that its calorific value and specific gravity correspond to district requirements. With a calorific value of 400 B.t.u. per cu.ft., the gas is at present enriched to 450 B.t.u. by the addition of butane, supplies of which are brought in by road from Grangemouth oil refinery, 35 miles from Westfield.

The butane for enrichment is unloaded from the road

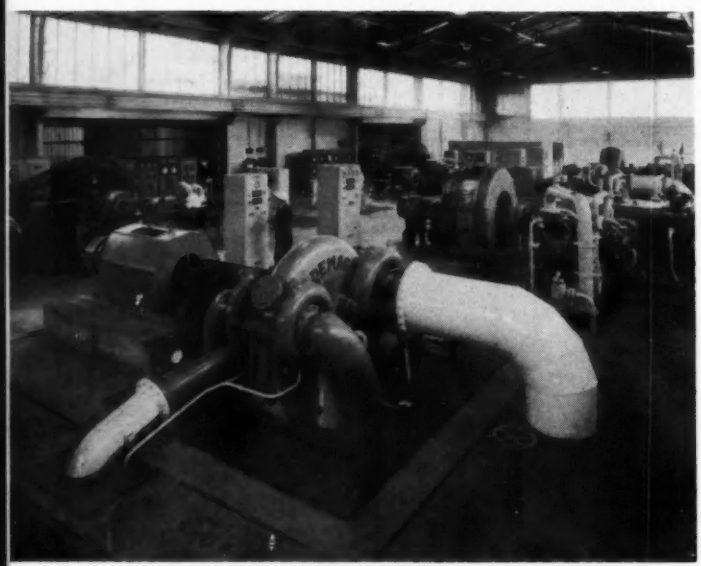
General view of the transfer tower and chimney.





The boiler house instrument panel is seen above.

Here is the oxygen plant compressor house.



tankers and stored in horizontal cylindrical tanks located in an enclosure at the western end of the works. There are three of these tanks—two of them manufactured by G. A. Harvey & Co. (London) Ltd.—and each is 53 ft. long by 10 ft. in diameter, weighing 21 tons, with a capacity of 26,950 gal.

Before finally entering the high pressure grid system, the purified, dried and conditioned gas passes through the station meter. Of German design and manufacture, this meter is of the positive rotary type and is known as model Zm 16.12d., supplied by the Sturtevant Engineering Co. Ltd.

It has certain unusual features, the most important of which is that it is one of the very few meters made as a pressure vessel to withstand very high pressures without special external protection.

Added to this it can give equally accurate metering in either a high or low pressure line. The meter handles up to 85,000 cu.ft. of gas per hour, which represents the actual volume passing through it at the particular operating pressure and temperature.

The necessary recording calorimeters for controlling the calorific value of the gas entering the grid system are of the Fairweather type and the complete installation was supplied by Scientific & Projections Ltd.

High pressure steam for the Lurgi gasifiers is raised in two Babcock and Wilcox bi-drum boilers, each capable of raising 45,000 lb. of superheated steam per hour at 450 p.s.i. and 730°F. A third boiler is under construction for stage 2 of the project.

First application

Each boiler is equipped with the Ignafluid stoker—its first application in Britain after development by the manufacturers with their French associates—and is intended to burn fuel with a particle size below $\frac{3}{8}$ in., preferably with a large proportion below $\frac{1}{8}$ in.

Crushed below $\frac{1}{4}$ in. before being delivered to the boiler house, the fine coal is fed to the boiler furnace by a vibratory feeder, and cascades on to the fuel bed which is maintained in a 'fluidised' condition by pulsated air streams injected below the narrow chain grate.

Inclined upwards towards the rear of the furnace, and equipped to travel from front to rear at a relatively high speed, this grate should be regarded only as an ash carrier.

Some of the fuel is burnt in suspension, the remainder burning on the sloping sides of the fuel bed between the boiler side walls and the grate.

The semi-molten ash flows by gravity down these sloping sides to the bottom of the fuel bed, and is conveyed by the chain grate as clinker to the rear of the furnace where it is discharged to the ash-removal plant.

Primary air from a forced draught fan is fed to compartments below the upper strand of the grate through divided trunking, equipped with regulating dampers which provide a decreasing air-pressure gradient from front to rear of the stoker. A motor driven 'pulsator' or rotary disc valve, in the forced draught fan outlet, creates the pulsations in the primary air flow through the grate to produce the continuous 'fluidisation' of the fuel bed.

Series of nozzles

Secondary air, the proportion of which to primary air may be varied between 40 and 60%, is introduced through a series of nozzles along the front and sides of the furnace, well above the sloping fuel-banks and the fluidised bed.

A small quantity of secondary air is also passed under the rear arch to ensure complete combustion. Control of the plant is semi-automatic, with the manual control of the forced-draught and induced draught fans.

To avoid difficulties which might be caused by the discharge of grit from the furnace stack, the high dust 'carry-over' problem is solved by 'dust re-cycling' whereby all dust passing through the boiler is mechanically collected and blown back into the furnace on either side of the coal admission port. The ash content of the fine coal being fed to the boilers is approximately 16%.

The production of high pressure oxygen for the Lurgi gasifiers is by the Tonnox plant designed and constructed by the British Oxygen Co. Ltd. Not only is this installation the first to be built on any British gasworks but it is the first time that liquid oxygen pumps have been used for the Lurgi gasification process.

In the oxygen plant air is liquefied and the nitrogen and other constituents separated.

The air to be separated is drawn into the plant through a filter by a turbo-compressor, delivering at about 72 p.s.i.g. After cooling, the air is next split into two streams.

The main stream is passed through one of the pair of alternating air/nitrogen regenerators where it is cooled almost to its condensation point with consequent elimination of impurities which are deposited on the packing.

Returning waste nitrogen is passed through the other regenerator and is warmed to approximately ambient temperature while recooling the packing and resubliming the impurities.

The air leaving the regenerators enters the lower column of a double column rectification system.

The second stream of air is further compressed in a four-stage reciprocating compressor to a pressure which depends on the amount of liquid oxygen to be produced.

The air is purified from carbon dioxide in a caustic soda scrubber between the first and second stages of the compressor.

The high pressure air is cooled to about 12°C. in an air cooler and after separation of the condensed water, dried in an alumina drier system. The purified high pressure air is then cooled in a heat exchanger system against returning nitrogen and compressed liquid oxygen, the latter being vaporised and delivered as product at pressures up to 600 p.s.i.g.

Part of the high pressure air is withdrawn from the heat exchanger system at an intermediate point and expanded isentropically in an engine to about 70 p.s.i.g.

The high pressure stream leaving the heat exchanger system is expanded through a valve to 70 p.s.i.g. and together with the expansion engine exhaust, added to the main air stream leaving the regenerators. The combined stream is then passed into the lower column.

The lower part of this column is fitted with a scrubbing section to remove residual impurities which are filtered off from the oxygen-rich liquid collecting at the base of the filter/silica gel purifier system which also removes traces of acetylene. This liquid stream passes through a subcooler before entering the upper column as feed.

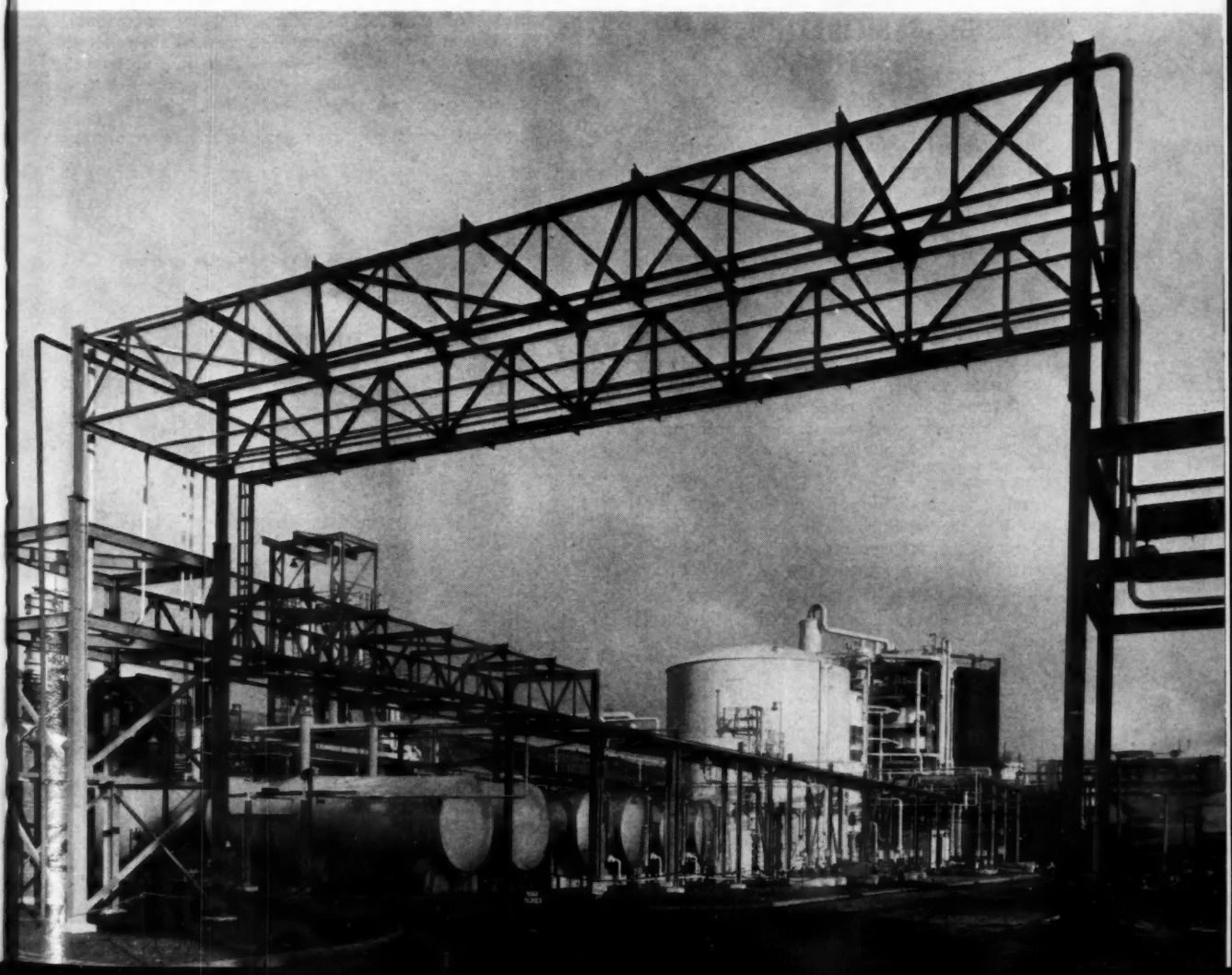
Lower column

The lower column operates at pressure of about 70 p.s.i.g. and carries a condenser. In this, nitrogen at lower column pressure is condensed by liquid oxygen boiling in the sump of the upper column.

The liquid nitrogen produced serves as reflux for the top of both columns, that for the upper column being passed through the subcooler before expansion into the upper column.

The nitrogen fraction is withdrawn from the top of the upper column and is passed through the subcoolers before

The by-products area.



leaving the air separation plant through the regenerators and heat exchanger system.

The liquid oxygen fraction is continuously withdrawn and compressed while still in the liquid state to a pressure of 426 p.s.i. in a pump of Byron-Jackson design operating at −183°C.—the temperature of liquid oxygen.

Vaporisation of the liquid takes place in a heat exchanger, after which it is preheated and passed to the Lurgi gasifier at the required pressure of 426 p.s.i.

The importance of the Westfield works as a key manufacturing station made it necessary that the oxygen supply should be completely reliable. To safeguard against unforeseen stoppages in oxygen production, it was decided to install a 560-ton liquid oxygen storage, from which supplies of gaseous oxygen could be drawn in cases of emergency or during the 'defrosting' of the plant.

It is an interesting point, that had a storage of equal capacity for gaseous oxygen been built, it would have cost more than £1 mill., whereas that actually installed has cost about one-tenth of this sum. The quantity stored represents 10% of the total capacity of the oxygen plant.

At present most of the nitrogen is blown off to atmosphere, but a proportion is stored in a small conventional gasholder of 50,000 cu.ft. capacity, supplied by Henry Balfour & Co. Ltd., from which it can be withdrawn for purging purposes. When, however, stage 2 is completed and the detoxification plant is working, nitrogen may be needed for 'conditioning' the purified Lurgi gas before it enters the grid system. An increased quantity, therefore, may have to be retained.

By-products from the plant include ammonia liquor, benzole and tar oils. Of these the ammonia liquor is treated in a Newton Chambers ammonia concentration plant to 24% ammonia, capable of handling up to 35,000 gal. of liquor a day, while the heavy fractions of the tar oils are retained for benzole extraction.

D and D design for LURGI

Once again our world-renowned standards of quality and efficiency have resulted in the selection of the following high quality pumps for the

LURGI PRESSURE-GASIFICATION PLANT WESTFIELD

Specially designed for this plant.

A Horizontal Duplex Pump designed for tar and coal dust. This outside packed Ram Pump is specially designed to give trouble-free service under heavy loads and incorporates several new features, including a special stuffing box to maintain efficient gland functioning at high pressures.

Other pumps installed at the plant are:—

Horizontal Duplex Pumps designed for tar loading. This design of pump incorporates several new features, including a specially designed stuffing box to ensure trouble free glands.

Motor Driven Pumps and Steam Jacketed Vertical Singlex Pumps were installed for handling a variety of fluids from the effluent and tar separator units, liquids handled being a mixture of tar, oil and ammoniacal effluent.

Dawson & Downie Ltd

Elgin Works, Clydebank. Tel: Cly. 2271-3
Telegrams: "Pumps, Clydebank."

HUMPHREYS and GLASGOW LTD

Selected

"SUPRETE"

UNIVERSAL METAL-TO-METAL JOINTING CEMENT AND FABRICATED JOINTINGS

For use on the new Lurgi Plant at Westfield, Fife, Scotland

★

YOUR TECHNICAL ENQUIRIES ARE INVITED BY THE MANUFACTURERS

CLOUGH (Croydon) LTD

229-231 LONDON ROAD · CROYDON · SURREY
Telephone: THOrnton Heath 2234

Electrical power for the plant is taken from the South of Scotland Electricity Board's system through two feeders at the 7-panel switchboard in the main incoming substation; provision also being made for a third emergency supply in the event of failure of the main feeders.

From this switchboard supplies are fed to the two subsidiary switchboards, a 7-panel at substation A and an 11-panel at substation B. At each of these substations two 4,000-kVA. transformers step-down to feed two 3.3-kV. switchboards. Two 1,000-kVA. transformers at substation A and four 1,000-kVA. transformers at substation B provide 433-volt T.P. and N. supplies for plant operation.

Switchboards

The 5-panel 3.3-kV. switchboards at substations A and B supply four 3.3-kV. motor starter switchboards. The latter consist of an 8-panel board at the Benfield plant, 5-panel and 4-panel boards at the oxygen plant and a 4-panel board at the cooling tower substation. These four switchboards are interconnnected so that each has duplicate supplies, one from substation A and one from substation B.

The circuit-breakers on the motor starter switchboards are used to control the motor-driven air compressors, and carbonate and cooling water pumps.

A further 200-kVA. transformer, fed from the switchboard at the main incoming substation, provides local 433-V. supplies.

The switchgear chosen for all the 11-kV. and 3.3-kV switchboards was Brush single-busbar, compound-insulated, type VBC designed to the Electricity Board's Specification S2. The circuit-breakers, rated at 400 and 800 A, are of the vertically-isolated, horizontal draw-out pattern, fitted with arc-control devices, and having a certified short-circuit making and breaking capacity of 250 MVA, at 11 kV. and 150 MVA at 3.3 kV.

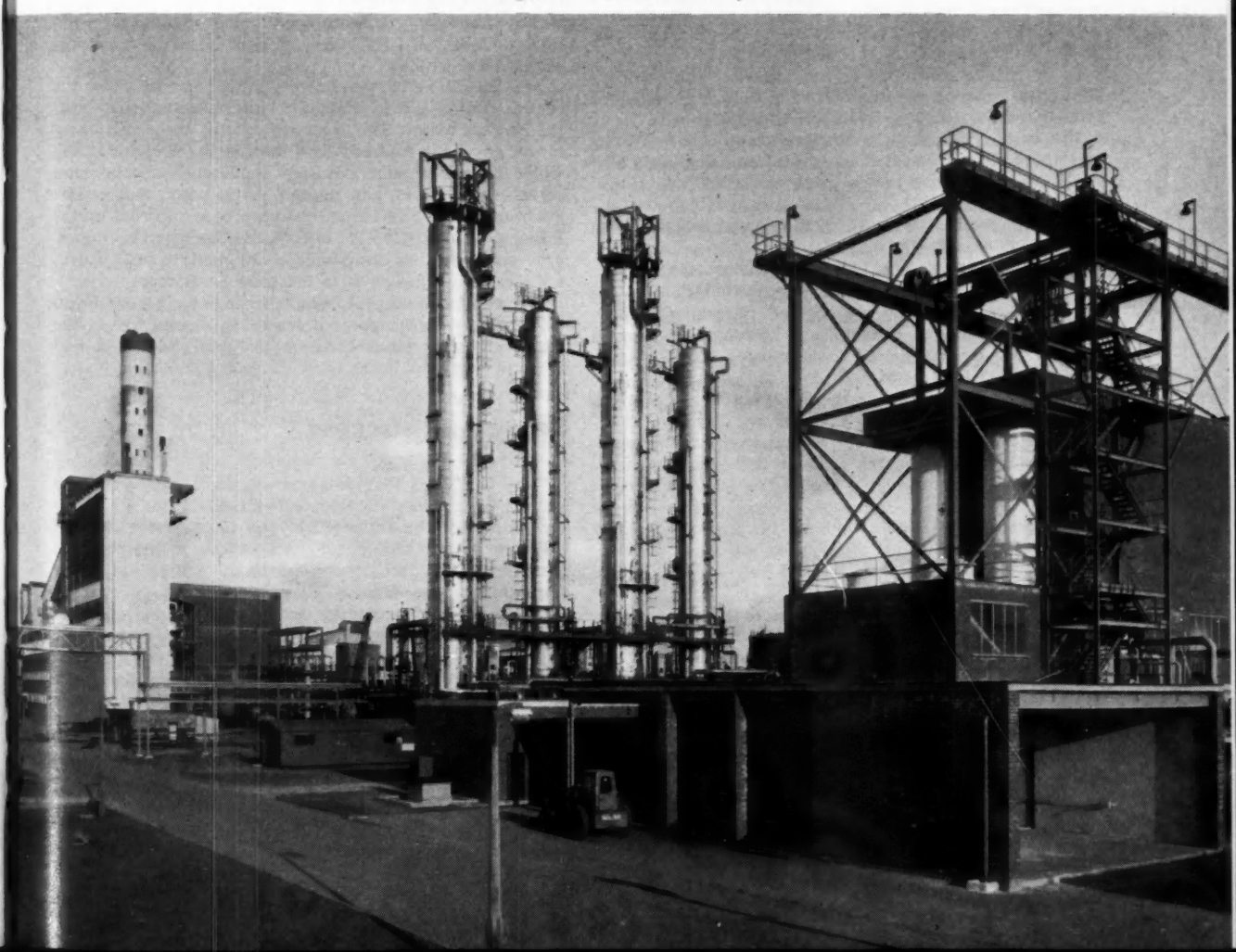
With the exception of those controlling the motors, all circuit-breakers have been equipped with hand-charged, spring-operated, power-closing mechanisms arranged for remote electrical release. On the motor circuits, the circuit-breakers have solenoid-operated, power-closing mechanisms to facilitate frequent operation.

Both the 11-kV. and 3.3-kV. feeders are protected by Translay unit protection, while the transformers have, in addition to Buchholz protectors, I.D.M.T.L. overcurrent and earth leakage protection on the 11-kV. side and restricted earth fault protection on the low-voltage side. The 3.3-kV. motors are protected by thermal and under-voltage relays.

The transformers, of the natural oil-cooled pattern with windings connected 41.Dyll, were manufactured by the Brush Electrical Engineering Co. Ltd., which was also responsible for the erection and commissioning of both the switchgear and transformers.

An automatic diesel alternator set capable of supplying

General view of Lurgi, Benfield and Bischoff purifier.



electricity for a 420-kW. load within 30 seconds of a mains failure has also been installed in case of emergency. It consists of a R4AUU 7-cylinder turbocharged and intercooled engine made by the National Gas and Oil Engine Co. Ltd., driving a 420-kW., 415-V., 3-phase, 50-cycles, Brush alternator. Ancillary equipment includes the set's exciter, switchgear and electric motors.

The engine, with a 9-in. bore and 12-in. stroke, is rated at 606 b.h.p. at 600 r.p.m., and works on the four-stroke principle; it is pressure-charged by a turbocharger. Compressed air for starting is admitted direct to the cylinders and is supplied by a compressor driven by a 2½-b.h.p., air-cooled diesel engine.

With the completion of stage 2 of the project, the fourth gasifier will have been added, a plant for the reduction of the carbon monoxide in the gas will be operating, and a sulphur recovery plant for the removal of sulphur from the waste gases will have been installed.

The effect of these additions will be to raise the output of the gasifiers by at least 50%, reduce the carbon monoxide content of the gas from 27% to below 8%. At the same time the carbon dioxide and hydrogen content of the gas will be increased as shown quantitatively by the shift reaction, with the result that at the outlet of the Benfield plant the gas will have a very low specific gravity of .3 or less.

'Conditioned' gas

To raise the specific gravity to .5 or thereabouts, the gas must be 'conditioned' by adding heavy gases such as carbon dioxide or nitrogen, and a gas of high calorific value, such as butane to raise the c.v. to the declared value of 450 B.t.u. per cu.ft. as referred to earlier.

In practice a controlled carbon dioxide 'slip' will be allowed to occur at the Benfield plant, though a controlled quantity of nitrogen may also have to be admitted.

The carbon monoxide conversion plant will be of the catalytic type and, installed at the outlet of the waste heat boilers, will treat hot Lurgi gas at about 107°C. It will make use of the water vapour in the gas to promote the shift reaction without recourse to high pressure steam from an external source.

In this way, not only will overall efficiency be increased, and the economics of the process improved, but one of the disadvantages of the Lurgi fixed-bed process that more than half the steam admitted for gasification passes through the fuel bed undecomposed to be condensed as effluent, may in part at least be overcome.

This plant will in fact be the first 'raw gas conversion plant' to be installed outside Germany.

Gas is available from the Westfield works at 250 p.s.i., the highest pressure ever used in Great Britain for the distribution of town gas through a grid of this size; the pipeline for carrying this gas to local grid systems round Glasgow in the west and Perth and Dundee in the north, is designed for a maximum working pressure of 300 p.s.i. Already some 75 miles linking Coatbridge and Newport to Westfield has been laid.

The Scottish national supergrid as at present contemplated, comprises some 260 miles of steel high-pressure pipeline, ranging in size from 12-in. to 2-in. diameter, and the initial approach in planning the routes was to lay the pipes in the most direct line possible across country, avoiding built-up areas. However, geographical conditions and the need to avoid natural obstacles, land subject to severe mining subsidence, and areas of opencast mining presented many problems. A number of diversions had to be made, and two major obstacles were the Rivers Forth and Tay. To cross the River Forth, the Board undertook the longest river bed crossing ever carried out in Britain at a point 2½ miles upstream from the Kincardine Bridge, where twin 12-in. diameter steel pipes were laid from shore to shore, a distance of approximately 2,000 feet. To cross the River Tay pipes will be laid across the two-mile long Tay railway bridge.

As short sections of the pipeline are completed they are subjected to an initial air test for soundness at 100 p.s.i., later to be followed by a strength test under a minimum hydraulic pressure of 450 p.s.i. which is carried out on as great a length of pipeline as it is practicable to test.

Finally, a 100-p.s.i. air test is applied to the entire length of line under construction, and maintained for a sufficient period to ensure that the pipeline is 'bottle tight.'

The technique of pipeline construction employed is that developed for long distance cross-country oil pipelines and natural gas transmission lines in America and the Middle East. Under the most favourable conditions so far experienced during the construction of the Board's supergrid, the maximum rate of laying has been over 2,000 yards a day.

When finally completed—construction on the supergrid started in June, 1958—the total length of grid mains within the Board's area, both the supergrid operating at 250 p.s.i. and the ordinary grid mains operating at up to 25 p.s.i. will be in the order of 1,100 miles, and will constitute a national gas grid for Scotland.

The operation of the super grid is directed from the central control room referred to above and situated near the Benfield plant. The necessary control room instrumentation has been supplied by Elliott Bros. (London) Ltd., while the gas pressure reducing regulators, back pressure valves, relief valves, and shut-off valves used on the super grid—and new to this country—have been supplied by the Fisher Governor Co. Ltd., direct to the Scottish Gas Board. This same firm has also supplied automatic control valves for the gas-making plant to the chief contractors.

The commissioning of Westfield was carried out in an astonishingly short space of time. Coal was fed to the gasifiers on December 22, 1960, and gas was first fed to the grid five days later.

Secret of success

Very few snags were encountered, and the secret of the success of this easy start-up undoubtedly lay in the excellent design of the entire plant and in the very careful attention which had been given to every detail of the programme of checking and testing all equipment before any attempt was made to commission it.

The large commissioning team which carried out this stringent preparatory plan included representatives of Lurgi and personnel from the main sub-contractors. During this period too, Scottish Gas Board operators were trained by the commissioning team, and Humphreys & Glasgow's supervision was gradually withdrawn and the plant handed over to its permanent operators.

The plant was started up ahead of the contracted date, itself a tribute to the highly successful co-ordination of the project. At its peak the total labour force was approximately 1,000.

METAL WORK
MAIN ENTRANCE GATES CONSTRUCTED IN TUBULAR STEEL WITH WELD MESH PANELS
By
CHARLES HENSHAW & SONS LTD.,
Russell Road, Edinburgh,

WESTFIELD CONTRACTORS

Chief Contractors: Humphreys & Glasgow Ltd., London.

Among the principal sub-contractors were:
A.E.I. Ltd., *Rugby, Warwicksire.*
Audley Engineering Co. Ltd., *Newport, Salop.*
Henry Balfour & Co. Ltd., *Leven, Fife.*
Babcock & Wilcox Ltd., *London.*
British Oxygen Linde Ltd., *London.*
British Rototherm Co. Ltd., *London.*
Broom & Wade Ltd., *High Wycombe, Bucks.*
B.T.R. Industries Ltd., *London.*
Consett Iron Co. Ltd., *Consett, Co. Durham.*
Clough (Croydon) Ltd., *Croydon, Surrey.*
R. Cort & Sons Ltd., *Reading, Berks.*
Crane Ltd., *London.*
Cuxson, Gerrard & Co. Ltd., *Oldbury, Birmingham.*
Dawson & Downie Ltd., *Clydebank, Scotland.*
Saml. Denison & Son Ltd., *Leeds.*
Elliott Bros. Ltd., *London.*
Ether Ltd., *Birmingham.*
G. A. Firkins Ltd., *Bromsgrove, Worcs.*
Firth Blakeley Sons & Co. Ltd., *Church Fenton, Yorks.*
Fisher Governor Co., *Rochester, Kent.*
W. J. Furse & Co. Ltd., *Nottingham.*
L.P. Gas Equipment Ltd., *Birmingham.*
Hartons Installations Ltd., *Crayford, Kent.*
Charles Henshaw & Son Ltd., *Edinburgh.*
Honeywell Controls Ltd., *Greenford, Middlesex*
The Hydronyl Syndicate Ltd., *London.*
W. J. Jenkins & Co. Ltd., *Retford, Notts.*
Kleen-E-Ze-Brush Co. Ltd., *Bristol.*
Richard Klinger Ltd., *Sidcup, Kent.*
Lincoln Electric Co. Ltd., *Welwyn Garden City, Herts.*
Mavor & Coulson Ltd., *Glasgow.*
Murex Welding Processes Ltd., *Waltham Cross, Herts.*
Newton Chambers & Co. Ltd., *Sheffield.*
Parkinson Cowan Gas Meters, *London.*
Power-Gas Corporation Ltd., *Stockton-on-Tees.*
Pulsometer Engineering Co. Ltd., *Reading, Berks.*
Richard Thomas & Baldwins Ltd., *London.*
Scientific & Projections Ltd., *Foots Cray, Kent.*
Sigma Instrument Co. Ltd., *Letchworth, Herts.*
Simon-Carves Ltd., *Stockport, Cheshire.*
Walter Slingsby & Co. Ltd., *Keighley.*
Stanton Ironworks Co. Ltd., *Nr. Nottingham.*
Steel Radiators Ltd., *Southall, Middlesex.*
Stewarts & Lloyds Ltd., *London.*
Victaulic Co. Ltd., *London.*
Walker Crosweller & Co. Ltd., *Cheltenham, Glos.*
Thomas Ward Ltd., *London.*
Wellington Tube Works Ltd., *Tipton, Staffs.*
Westwood & Wrights Ltd., *Brierley Hill, Staffs.*
Winn & Coales Ltd., *London.*
Yorkshire Imperial Metals Ltd., *Leeds.*

BOOK REVIEW

FLOW PHENOMENA WHEN FILLING HIGH PRESSURE GASHOLDERS FOR THE FIRST TIME

By Dipl.-Ing. I. Keunen,

Gäswärme Institut e.V., Essen-Steele.

THIS is one of nearly 1,000 reports on research in all branches of applied science, which is being sponsored by the Ministry of Education of the State of North Rhineland-Westphalia.

The purpose of the present report is to investigate flow and diffusion phenomena during the starting procedure of spherical high pressure gasholders, based on tests with a model. For this purpose, a spherical gasholder of 6 ft. 11 in. (2.10 m.) inner diameter and 171 cu.ft. (4.85 cu.m.) capacity was installed at the Gaswärme Institut in Essen, together with all the necessary instrumentation to measure flow, pressure, oxygen content and temperature of the gas.

The model sphere contained three horizontal rods to which rubber pipes were fixed so that gas samples could be extracted at different levels. The gas was introduced by a 2-in. diameter pipe at the bottom, and rising up to 4 in. from the top of the sphere while the outlet was also at the bottom.

During the tests which were carried out with varying rates of flow in the feed pipe, the percentage of air was measured both in the outlet pipe and at different levels in the sphere. The results were plotted on a probability graph, i.e., with co-ordinates in which linear abscissae represent the grid gas fed into the sphere in percentage of the total volume; the ordinates representing the percentage of air in the grid gas/air mixture at different points are logarithmic in scale, both below and above 50%, all test results lying along straight lines.

This indicates that diffusion phenomena predominate during the filling process. Based on the tests, a number of formulae were established which enabled the layer, within which the gas concentration amounted to 10 to 90%, to be calculated in percentage of the total volume of the sphere. During other tests, in which nitrogen was pumped into the sphere, containing air, it was found that the mixed gas layer remained small provided the Froude number did not drop below .68.

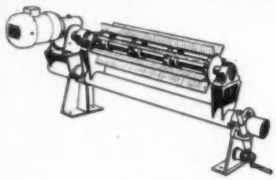
In conclusion, a recommended procedure for filling a spherical gasholder with nitrogen, followed by filling it with grid gas is established. After calculating the flow rate for nitrogen, the point is found where the nitrogen content in the gas mixture is 65%. If both the 65% N_2—35% air, and the 5% gas−95% air+N_2 lines are plotted in probability coordinates, their distance at the ordinate of 50% indicates the total amount of N_2 required.

Tests with the model confirmed the soundness of this recommended filling procedure. In full-scale spheres, differences from the model may be caused by convection, and care should be taken that weather conditions do not cause turbulence inside the gasholder. Dull weather is considered best from this point of view, together with a filling process which does not last too long.

No. 925 OF THE RESEARCH REPORTS OF THE STATE OF NORTH RHINELAND-WESTPHALIA. WESTDEUTSCHER VERLAG. COLOGNE AND OPLADEN.

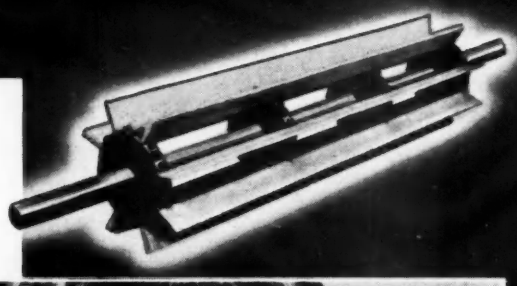
PRICE DM 12.60 (APPROX. £1 2s. 0d.).

The K·A·M CONVEYOR BELT BRUSH



The Kam self-contained motor-driven unit embodying the Kez strip rotor (above right).

Right: The brush in action. Records have shown less than 5% wear after 10,000 brushing hours.



THE Kleen·e·ze BRUSH CO. LIMITED

146 BEVAN LANE HANHAM, BRISTOL

STRAINERS "Y" TYPE

FORGED OR CAST in Steel, Bronze, Stainless Steel, Monel and light alloy

British Standard Continental and A.S.A. Flange Sizes ¼"—14" N.P.B.

PRESSURE UP TO 10,000 P.S.I. P.F.D. APPLICATIONS

Also — Motorised Valves, H.P. Sintered Metal Filters, Powder Fluidizing Vessels, Oily Water Separators, Hand Pumps, Special Purpose Plant . . .

G. & A. FIRKINS LTD.

FIRTOP WORKS, STOKE HEATH, BROMSGROVE, WORCS.
Tel: BROMSGROVE 3246/7/8

We welcome your enquiries for the above products & also for items to customers own design and specification

FIRTOP

NEWS SUPPLEMENT

Minister makes helicopter flight to open Padiham works of Main Morley Ltd.

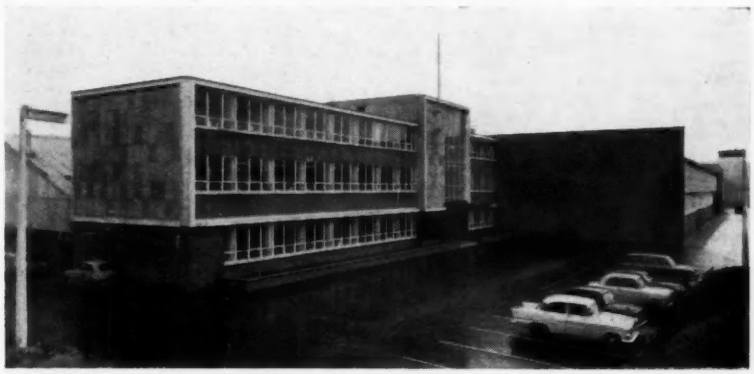
A HELICOPTER flight from London, where he had been called to an urgent meeting, brought the Minister of Power, Mr. Richard Wood, to Gothic Works of Main Morley Ltd., at Padiham, Lancashire, last week, for the formal opening ceremony. The Minister unveiled a commemorative tablet recording the event.

The function was attended by distinguished personalities from the gas industry, who were entertained at luncheon at the Keirby Hotel, Burnley.

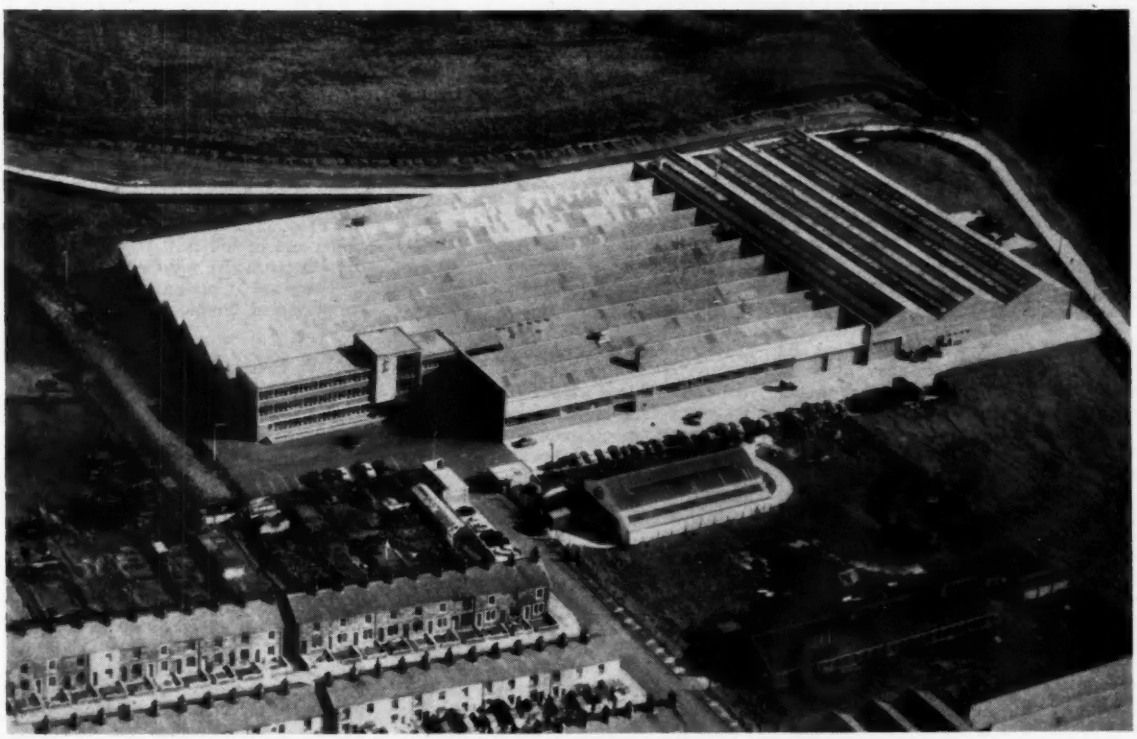
The Chairman of Main Morley Ltd., Mr. P. D. M. Aird, welcoming the guests made special reference to the part played in the success of the move from the South by the local authorities, particularly the Padiham Urban District Council. He said they now felt at home and added: 'You have been exceptionally kind to those of our company who have had to move from London to find new homes and friends.'

Explaining the reasons for the move, Mr. Aird said they were members of a group of companies, two of which were very small to carry on by themselves. These were Morley Products, making washing machines, and Main Water

EXPANSIVE FACTORY

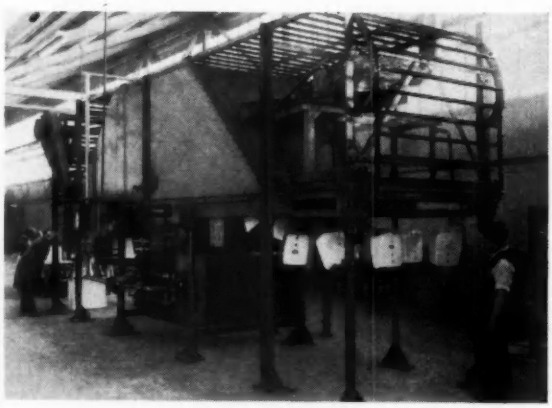


The office block of the Padiham works.



An aerial view of the new Main Morley Ltd. Gothic Works at Padiham, Lancashire.

Three machines help to form copper boiling pans for wash boilers and washing machines in the Main Morley Padiham works.



The paint shop houses two continuous camel back conveyor stoving ovens. The oven shown is gas-fired and thermostatically controlled.

The final stages of assembly of the Triton water heater after the heat exchanger units have been passed at the testing panel (rear).

Heaters, of Croydon. Both used gas and water in the appliances they sold and therefore it was a natural that they should join these two together.

The move was an easy one for Morley Products, but much more difficult for the Croydon company. They had a human problem and a physical one of transporting 2,000 tons of plant from London which, he claimed, was the biggest move of its sort ever undertaken by the London Midland Region of British Railways.

Behind the works they had some 25 acres of ground and it was their hope that before long they would be able to expand there.

Mr. W. K. Hutchison, Deputy Chairman of the Gas Council, who responded for the guests, said the move was a mark of faith by an old firm, faith in the future of the gas industry, which was supported and believed in by those on the production and selling sides. They believed that they had in gas a product which could meet any competition in the future.

The Managing Director of Main Morley Ltd., Mr. W. K. Tate, expressed thanks to Mr. Hutchison and the guests.

The visitors were then taken to see the works, a tour which was interrupted by the arrival of the Minister's helicopter.

Guests reassembled in the hall of the office block, where Mr. Wood then unveiled the tablet, and in a brief speech commended the firm, which had brought employment to that part of Lancashire.

Among those from the gas industry who attended, in addition to Mr. Hutchison, were: Dr. R. S. Edwards, Chairman, North Eastern Gas Board; Mr. J. H. Dyde, Chairman, Eastern Gas Board; Mr. W. Hodkinson, Deputy Chairman, North Western Gas Board; Mr. H. Butters, Member, North Western Gas Board; Mr. V. W. Stanton, Member, South Eastern Gas Board; Mr. J. V. Rodgers, Sales and Service Officer, North Western Gas Board; Mr. W. B. Harrison, General Manager, Central Lancashire Group, North Western Gas Board; Mr. N. Hudson, Commercial Manager, North Eastern Gas Board; Mr. R. J. Gregg, Publicity Manager, The Gas Council.

Directors of Main Morley Ltd., who attended, in addition to Mr. Aird and Mr. Tate, were: Mr. F. W. Chapman, Mr. A. G. Bazell, and Mr. G. F. Jenkins.

Officers of the Company who attended were: Mr. F. K. Morley, General Works Manager; Mr. J. M. Andrew, Sales Manager; Mr. G. R. Fitton, Accountant; Mr. S. H. Chadwick, Service Manager; Mr. I. A. Chapman, Works Manager; Mr. H. Morley, Works Engineer; Mr. M. J. N. Soley, Development Manager; and Mr. S. A. Grummitt, Publicity Manager, Glover and Main Ltd.

The visitors were received by the Board of Directors of Main Morley Ltd., headed by Mr. Aird and Mr. Tate.

WHAT IS MADE

Main Morley Ltd., a member of the Glover and Main Group of Companies, is responsible for the development, manufacture and marketing of all water heating and home laundry appliances produced within the Group. The new factory is devoted entirely to the production of these appliances.

The buildings cover approximately 150,000 sq.ft. and have been planned to provide a maximum of unobstructed floor area. This has been achieved by the introduction of roof spans of up to 140 ft. and a minimum of internal dividing walls.

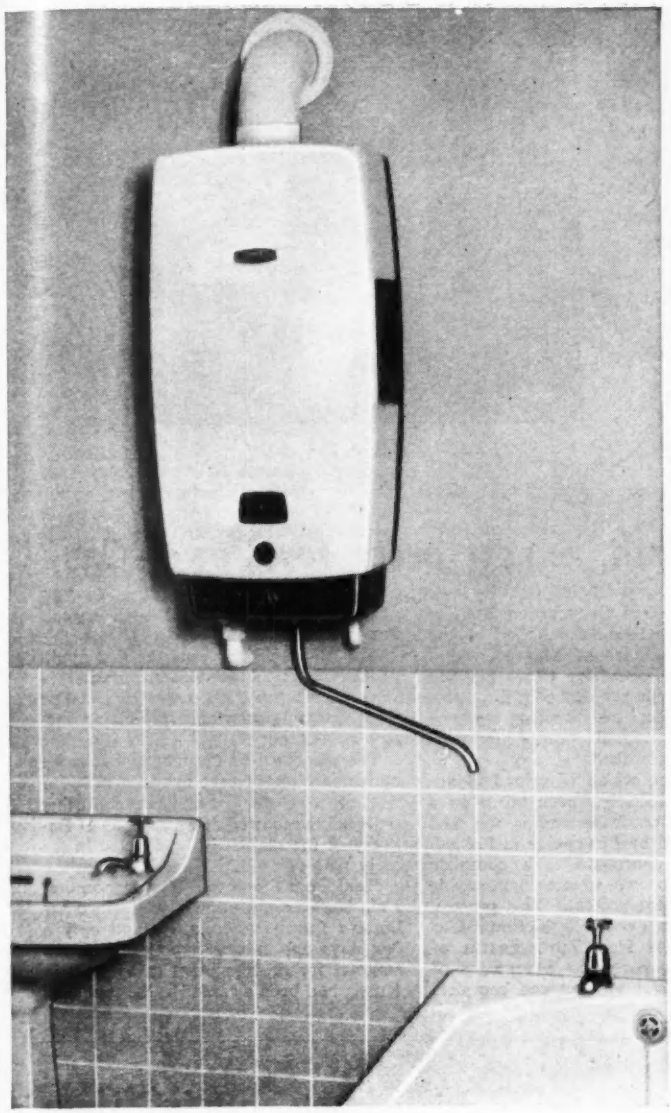
Apart from the three-storey administration block which forms an impressive frontage to the works, the buildings are all of a single storey and make a maximum use of natural lighting giving unusually attractive working conditions.

There are at present some 500 people employed at Gothic Works, Padiham.

CULMINATION

The opening of the new Gothic Works marks the culmination of an internal reorganisation programme within the Glover and Main Group, the object of which has been to expand production of both water heating and home laundry appliances and to give scope for coordinated research and development for both types of appliance.

The Company of Main Morley Ltd. was formed in 1960, as mentioned by Mr. Aird at the luncheon, by the amalgamation of two of the Group's established trading companies, the water heater manufacturing company of Main Water Heaters Ltd., Croydon and the home laundry appliance production company, Morley Products (Padiham) Ltd. The



The next step in bathroom water heating is here

MAiN

Triton Thermostatic

No more tepid baths or running cold with the Triton Thermostatic! The unique automatic control of the thermostat ensures an endless and consistent supply of hot water at a constant temperature of 130°F. immediately the tap is turned. The water outlet temperature is held constant over a wide range of inlet temperatures and the heater can tolerate reductions in water pressure without the outlet temperature being substantially affected and without the gas being extinguished. Thus the advanced design of the Triton allows operation under conditions of low mains pressure.
When connected to the draw-off pipe of an existing hot water system it will boost the temperature of partially heated water at that delivery point to a usable level — an economy at any time of the year. The Triton Thermostatic serves as a single point heater for the bath or as a dual point with swivel spout serving both bath and basin. Swivel spouts of 12 in., 15 in., 18 in., 21 in., and 24 in. throw are available.

Instant hot water at a Thermostatically Controlled temperature!

LiVE MODERN WiTH MAiN

MAIN MORLEY LIMITED · PADIHAM · LANCS

W 78

amalgamation of the two companies had been envisaged some time prior to 1960 when the new factory was completed at a cost of approximately half a million pounds.

The entire plant and machinery of the two original companies is now housed in the new works.

The move required careful planning so as to interfere as little as possible with the continuance of production.

The Company has been fortunate in that almost the entire administrative, technical and development staffs, at the higher levels, agreed to move from Croydon to Padiham and their wide experience in water heating matters, both from the commercial and the production points of view, has proved of inestimable value in establishing the new enterprise.

The Minister of Power Mr. Richard Wood, unveils the tablet at Gothic Works, Padiham, during the opening of the new Main Morley Ltd. factory.

SUPERVISORY STAFF

Furthermore, a number of supervisory staff on the shop floor also consented to come to Padiham and have proved of outstanding worth, not only in controlling operations but also in training new personnel unfamiliar with the work that was necessary.

The Padiham Urban District Council placed the requisite number of houses at the Company's disposal for the occupation of the staff coming up from Croydon.

The occupation of the new factory was completed on schedule towards the end of last year, with the works having been carefully laid out to make full and economical use of plant and labour.

PROCESS SHOPS

The various process shops are simultaneously engaged on the production of components for both water heating and laundry appliances, allowing flexibility in output to suit changing market requirements. The new Padiham Works has been in production only a few months and output has already exceeded that achieved in the old works.

This new factory at Padiham now provides the Glover and Main Group with the capacity and facilities to produce any quantity of gas water heaters and home laundry appliances which may be required to enable the Gas Council and area gas boards to develop the gas water heating and home laundry loads to the full.

£1½ mill. export order for Power-Gas

THE Power-Gas Corporation Ltd., of Stockton-on-Tees (a member of the Davy-Ashmore Group) has received a contract from Poland for a urea plant to produce 500 tons per day of prilled product for fertiliser use, including the production of a small proportion used directly as cattle feed.

This contract, which is valued at approximately £1½m. has been taken on a deferred payment basis and is the first contract gained by Power-Gas in Poland.

The plant concerned is a complete recycle unit in two streams, employing the Toyo Koatsu process. This process, which has been licensed to the Power-Gas Corporation Ltd. from Toyo Koatsu, of Japan, has the particular advantages of low biuret crystal product and complete flexibility in production of both crystals and prills.

This contract represents the first application of the Toyo Koatsu process in Europe. The new plant will be installed at an existing ammonia producing factory in Poland.

The plant will be the first of five to be built under the present five-year plan for Poland, with the possibility of further units being required at a later stage. Delivery of the plant will be effected in the early part of 1963.

Plant from the Power-Gas Corporation Ltd., has recently been installed in other Eastern European countries and only a few days ago it was announced that a contract for process plant to be built in Russia had been awarded to the company.

Long service awards

A TOTAL of 1680 years of service with the one industry was acknowledged when 42 employees of the North Thames Gas Board, each with 40 years to his credit, were presented with long service awards by Mr. Michael Milne-Watson, Chairman of the Board.

More natural gas is found in Sahara

MORE natural gas has been struck in the Sahara by the French State-controlled oil Company in association with Phillips Oil Company, of the U.S., says the Paris correspondent of *The Financial Times*.

The bore-hole, situated at Gassi Touil, was drilled by Copefa (Compagnie des Petroles France-Afrique) in a joint venture with Phillips Oil and Omnirex (a Private French oil exploration company).

The deposit is believed to be as important as that at Hassi R'Mel—which is the second largest in the world—if initial tests are confirmed.

Simon Engineering: 1960 results

The net profit of the Simon Engineering Group for the year ended December 31, 1960, after provision for taxation, is £1,339,387, and the total available for appropriation by Simon Engineering Ltd. is £1,171,859.

The Directors have paid or propose dividends on preference shares of 6% less tax, and on ordinary shares an interim dividend of 10% less tax, and a final dividend of 17½% less tax.

A balance of £989,916 is brought forward from the previous year, the amount carried forward to 1961 being £614,952.

A heavy fabrication shop 300 ft. long, with an 80 ft. span, is to be built by Henry Balfour & Co., Ltd., at Mountfleurie, Leven, on a new 25-acre site adjacent to their research and development centre.

PERSONAL NOTES

DR. J. BURNS, G.M., Deputy Chairman, North Thames Gas Board, has been elected President of the Institute of Fuel. He will take Office in October, 1961. SIR HAROLD HARTLEY, G.C.V.O., C.B.E., M.C., has been made an Honorary member of the Institute. Sir Harold was chairman of the Fuel Research Board of the D.S.I.R. from 1932 to 1947; chairman of the British National Committee and of the International Executive Council of the World Power Conference from 1935 to 1950; and president of the Conference from 1950 to 1956.

MR. G. A. JONES, formerly South Wales regional manager of Grant, Lyon & Co. Ltd. of Scunthorpe, Lincolnshire, the railway and civil engineering Company of the Chamberlain Group of Companies, has now been appointed the Company's Technical Representative for the whole of England and Wales, with the exception of Durham and Northumberland. Mr. Jones, who joined the Company in 1956, can be contacted at 17, Gillian Road, Highfield, Llandaff, Cardiff.

MR. C. S. SHAW has been appointed Assistant Managing Director of R. H. Neal & Co. Ltd. of Grantham, one of the Steel Group of Companies. After 23 years with K & L Steelfounders & Engineers Ltd., 16 of which were spent as technical director, Mr. Shaw is returning to Neals, where he designed the original Neal mobile cranes 30 years ago.

MR. ALFRED ROBENS, Chairman of the National Coal Board, has been made a Life Peer. Mr. Robens was parliamentary secretary to the Ministry of Fuel and Power from 1947 to 1951, and Minister of Labour and National Service in 1951. MRS. J. M. SPENCER, Assistant Secretary to the Ministry of Power, has been awarded a C.B.E.

ARTHUR SMITH

Mr. G. le B. Diamond, Chairman of the West Midlands Gas Board, writes:

The news of the death of Arthur Smith on June 9 came as a shock to his many friends in the gas industry. Right up to the last he seemed youthful and buoyant, and was always surrounded by an atmosphere of cheerful good humour. A great raconteur, particularly of Black Country stories, he was popular for after dinner speeches or for the more informal corner of the Nineteenth Hole. He was widely known in the Midlands, and greatly esteemed throughout the gas industry for his long and distinguished service to the City of Birmingham and to the pre-vesting national bodies of the industry. After 50 years' service he retired in 1945, but responded to the request of the Minister and came back from retirement to help in the formative period of the West Midlands Gas Board in 1949. His services at that time were invaluable and he entered wholeheartedly into the spirit of making a success of the newly nationalised gas industry. 'A.W.' as he was affectionately referred to, was much sought after for advice on a multitude of problems and could be relied upon to give a wise solution from a rich store of experience. With a twinkle in his eye and a smile on his face, he was welcomed wherever he went and he will be sadly missed.

COMING EVENTS

July 6.—EAST MIDLANDS G.C.C.: Nottingham Chamber of Commerce, Smithy Row, Nottingham. Annual Meeting. 11 a.m.

J. BROWN & CO. LTD
SAVILE TOWN, DEWSBURY, YORKS.
Supply:—
"BROWNOX-de-LUXE"
PURIFYING MATERIAL
Purchase:—
SPENT OXIDE

WYNDHAM HAMMOND LTD.
DECORA WORKS • WOLVERHAMPTON ST. • DUDLEY • WORCS.
Tel: DUDLEY 54551-2-3
SPECIALISTS IN:
1. Design and Fabrication of all types of Light Steel Structures
2. Stripping and Re-sheeting and Glazing of Roofs
3. Structural Steel Painting
4. Insulation of Buildings

IN FACT

5. We can prepare Drawings and Schemes for New Development. Design, *Fabricate* the Steel, Sheet, Glaze and Paint. The whole of the project being carried out under *one* organisation.

INSTEAD OF FOUR OR FIVE CONTRACTORS— WE CARRY OUT THE WHOLE SCHEME!!

The
LIMIT OF EFFICIENCY
CAN BE REACHED
by the use of
LUX
GAS PURIFYING MATERIAL
Sole Importers:
HARRISONS (London) LIMITED
66, Mark Lane, LONDON, E.C.3
Telephone: ROYal 3120 Telegrams: Birchrock, London

GAS METER CRANKS Telephone: DUNSTABLE 64301
THE CLIFFORD ENGINEERING CO., LTD.
DUNSTABLE, BEDS.
Specialists for over 35 years
SINGLE AND DOUBLE THROW CRANKS FOR ALL METERS

PATENTS and TRADE MARKS
KINGS PATENT AGENCY, LTD.
Director, B. T. King, A.I.M.E.), Patent and Trade Mark Agents, 146a Queen Victoria Street, London, E.C. Booklet on request. City 6161.

PLANT FOR SALE
ANNEALING Furnace, 32-ft. long × 14-ft. × 14-ft. Town gas. Complete with control panel, also gas mixing plant. Box No. 385, *Gas Journal*, 11, Bolt Court, Fleet Street, E.C.4.

PLANT AND MACHINERY WANTED
WANTED.—Inert Gas Generator, either Gas or Diesel fired, capacity approx. 3,000 cu.ft. Holmes/Harrison type or similar.
Full details to Box 386, *Gas Journal*, 11, Bolt Court, Fleet Street, London, E.C.4.

Cases For Permanent Binding
Quarterly Volumes of the 'Gas Journal'
9/6 each, post free
Walter King, 11, Bolt Court, Fleet Street, London, E.C.4

APPOINTMENTS VACANT

WALES GAS BOARD
PORT TALBOT UNDERTAKING

DISTRIBUTION ENGINEER

APPLICATIONS are invited from suitably qualified persons for the above appointment.

Applicants must be experienced in Modern High/Low Pressure Gas Distribution Practice, including mainlaying, planning, also consumer service and showrooms. The person appointed will be expected to perform duties in connection with distribution work for other Undertakings in the Mid-Glamorgan Group.

Applicants must also be strongly interested in overall sales development, with particular reference to domestic space heating.

The salary payable will be within Grade A.P.T. 12, Provincial 'A' (£1,115-£1,260), commencing at a figure commensurate with qualifications and experience.

The successful applicant will be required to pass a medical examination and to join the Wales Gas Board Pension Scheme.

A house will be made available at a reasonable rental.

Applications, stating age and experience, and giving full particulars of training and qualifications, together with the names of two Referees, should be received by the undersigned within 14 days of the appearance of this advertisement.

W. F. EDWARDS,
General Manager and Secretary.

Gas Offices,
18, Station Road,
Port Talbot.

June, 1961.

SOUTH EASTERN GAS BOARD
HOME SERVICE ADVISER

EPSOM (SURREY) AREA

HOME SERVICE ADVISER required, initially for the Epsom (Surrey) area. The successful applicant will be required to conduct demonstrations, give lectures and advise consumers in their homes in the use and care of gas equipment.

Applicants must have undergone training for two years at a recognised training college of Domestic Arts, hold a diploma in cookery, housewifery and laundry work.

Salary 21 years of age and over within Grades 4-6 (Metropolitan area) £535 p.a. to £840 per annum according to experience.

Applications in writing, giving full details and quoting reference V10/1489, should be sent to the Personnel Manager, SOUTH EASTERN GAS BOARD, Katharine Street, Croydon, within seven days.

SOUTH EASTERN GAS BOARD
INDUSTRIAL REPRESENTATIVES

VACANCIES exist for Industrial Representatives in areas centred on Croydon and Maidstone. The work covers the application of gas for commercial uses and for industrial purposes.

Applicants should have had technical and/or engineering training, which need not necessarily have been related to the utilisation of gas.

Preference will be given to those holding the Higher National Certificate in Mechanical Engineering or an equivalent qualification.

Salary within grades 7, 8 or 9, according to experience and qualification:—
Croydon (Metropolitan Area) £800-£1,050 p.a.
Maidstone (Provincial 'A') £770-£1,015 p.a.

Applications in writing, giving full details and quoting reference V10/1487, should reach the Personnel Manager, Katharine Street, Croydon, within seven days.

WEST MIDLANDS GAS BOARD
WOLVERHAMPTON & DISTRICT DIVISION

VACANCY FOR
ASSISTANT CHEMIST, WOLVERHAMPTON

CANDIDATES must possess the Higher National Certificate in Chemistry or equivalent qualification and have had some years experience in the chemical control of Works Plant.

The salary will be within the range £770-£870 per annum.

Living accommodation in the form of a modern ground floor flat may be made available if required.

Applications, giving details of qualifications and experience, should be addressed to Mr. Stanley Jones, Divisional General Manager, West Midlands Gas Board, P.O. Box 34, Bath Street, Dudley, Worcs., **to reach him not later than June 30, 1961.**

WEST MIDLANDS GAS BOARD
WARWICKSHIRE DIVISION

VACANCY FOR
DISTRIBUTION INSPECTOR—RUGBY DISTRICT

THE duties attached to the post will include responsibility for all Distribution work at the district, supervision of labour and control of associated clerical staff.

Candidates should possess a sound practical knowledge of main and service laying, and the maintenance involved on a high and low pressure distribution system. They should also have experience in the organisation and control of distribution works carried out by direct and contract labour.

The salary will be within the range £830-£930 per annum.

Applications, stating age, qualifications, training and experience, should be addressed to Mr. A. Allen, Divisional General Manager, West Midlands Gas Board, Gas Street, Coventry, **to reach him not later than June 28, 1961.**

WEST MIDLANDS GAS BOARD
WORCESTERSHIRE/HEREFORDSHIRE DIVISION

VACANCY FOR
SHOWROOM MANAGER,
KIDDERMINSTER

CANDIDATES should be experienced salesmen with a good knowledge of all aspects of Sales and Service, Showroom procedure and display.

The salary will be within the range £710-£810 per annum.

Applications stating age, qualifications, training and experience should be addressed to Mr. K. E. Jones, Divisional General Manager, West Midlands Gas Board, Newton Road, Worcester, **to reach him not later than June 28, 1961.**

WEST MIDLANDS GAS BOARD
WARWICKSHIRE DIVISION

VACANCY FOR
ASSISTANT ENGINEER,
FOLESHILL WORKS, COVENTRY

CANDIDATES should be Associate Members of the Institution of Gas Engineers or possess equal qualifications. They should have had experience in the control and operation of continuous vertical retorts and carburetted water gas plants.

The salary will be within the range of £770-£870 per annum.

Applications, stating age, education and experience, should be addressed to Mr. A. Allen, Divisional General Manager, West Midlands Gas Board, Gas Street, Coventry **to reach him not later than June 30, 1961.**

RADIATION LIMITED will shortly have vacancies in their Gas Cooker Research Laboratory for Staff to undertake research and development work on domestic gas cookers. Candidates should preferably be graduates in Physics, Chemistry or Fuel Technology, or have had previous experience in this type of work. Applications giving full details of age, qualifications, experience, and present salary to: Personnel Officer, Radiation New World Limited, Warrington Production Centre, Grappenhall Works, Warrington, Lancs.

ASSISTANT MARKETING OFFICER

APPLICATIONS are invited for the post of Assistant to the By-Products Marketing Officer at the National Coal Board's Durham Divisional Headquarters, which will shortly be moving from Newcastle to the Team Valley Trading Estate, Gateshead.

A knowledge of the various by-products produced from coal carbonisation is essential. The person appointed will be required to act in the absence of the Marketing Officer and he will be responsible for the movement of all products and the general supervision of clerical staff.

Salary will depend on qualifications and experience, on the scale £925 × £35—£1,200. Excellent Superannuation Scheme.

Apply within seven days to D.C.S.O., N.C.B., Team Valley Trading Estates, Gateshead, 11, quoting SG/120/38(26).

LONDON ELECTRICITY BOARD
SENIOR DEMONSTRATOR

APPLICATIONS are invited for the above position in the Board's Southern District. The successful candidate will be based at 505, Norwood Road, S.E.27, but will be required to work anywhere within the District.

Applicants should be suitably qualified, holding the E.A.W. Diploma or other approved qualification, including Electrical Housecraft, and have experience in conducting demonstrations in Showrooms, public halls, schools and at exhibitions. They should have sales ability and be experienced in advising consumers on the selection and use of all types of domestic appliances and be capable of demonstrating such apparatus.

The post is graded within the National Joint Council Agreement (Administrative and Clerical Grades) as Grade 2, i.e., £700 to £775 per annum, plus the appropriate London Area Allowance.

Applications stating age, qualifications and experience should be sent to the Manager at 54, Bengeworth Road, S.E.5. Please quote ref.: PER/V/3320/GJ.

INVERCARGILL CORPORATION GAS DEPARTMENT
SOUTH ISLAND—NEW ZEALAND
DISTRIBUTION SUPERINTENDENT

APPLICATIONS are invited for this position from married men between the ages of 25 & 40 years. Applicants are required to have a sound practical and technical knowledge of all phases of low pressure Gas Distribution while energy and initiative and ability to handle labour is essential.

The Department sells over 60 million cu.ft. per annum and has good potential to expand in a rapidly growing city and province. A Superannuation Scheme is operated by the Council and a commencing Salary of N.Z. £1,100 will be paid. Temporary rental housing is provided though permanent accommodation must be provided by the appointee.

Applications should be accompanied by details of education, experience and marital status, also two recent testimonials and sent to William Coward & Co. Ltd., 3, St. James's Square, London, S.W.1. not later than the 30th June, 1961.

SPECIALLY ACTIVATED **SUPEROX** OXIDE OF IRON

Manufactured and Distributed by

GAS PURIFICATION LIMITED

9 ORMOND CLOSE, BOSWELL STREET, LONDON, W.C.1